HONI SOIT QUI MAL Y PENSE
DIEU ET MON DROIT

AGRICULTURAL RESEARCH INSTITUTE

PUSA

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM

VOLUME 61

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

ADVERTISEMENT.

The scientific publications of the National Museum consist of two series—Proceedings and Bulletins.

The Proceedings, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original papers based on the collections of the National Museum, setting forth newly acquired facts in biology, anthropology, and geology derived therefrom, or containing descriptions of new forms and revisions of limited groups. A volume is issued annually or oftener for distribution to libraries and scientific establishments, and, in view of the importance of the more prominent disseminations of new facts, a limited edition of each paper is printed in pamphlet form in advance. The dates at which these separate papers are published are recorded in the table of contents of the volume.

The present volume is the sixty-first of this series.

The Bulletin, publication of which was begun in 1875, is a series of more elaborate papers, issued separately, and, like the Proceedings, based chiefly on the collections of the National Museum.

A quarto form of the Bulletin, known as the "Special Bulletin," has been adopted in a few instances in which a larger page was deemed indispensable.

Since 1902 the volumes of the series known as "Contributions from the National Herbarium," and containing papers relating to the botanical collections of the Museum, have been published as Bulletins.

William deC. Ravenel,
Administrative Assistant to the Secretary,
in Charge of the United States National Museum.

January 10, 1923.

TABLE OF CONTENTS.

Page.

Aldrich, J. M. Two-winged flies of the genera Dolichopus and Hydrophorus collected in Alaska in 1921, with new species of Dolichopus from North America and Hawaii. No. 2446. May 3, 1922[1] 1-18

New species: *Dolichopus fortis, D. pensus, D. simplicipes, D. crassicornis, D. inflatus, D. delicatus, D. elegans, D. longus, D. recticosta, D. abruptus, D. townsendi, D. exsul, Hydrophorus aquatilis.*

Bassler, Ray S. (See Canu, Ferdinand) 1-160

Canu, Ferdinand, and Ray S. Bassler. Studies on the Cyclostomatous Bryozoa. No. 2443. October 9, 1922[1] .. 1-160

New families: Lobosoeciidae, Cerioeavidae.

New genera: *Atractosoecia, Trigonoecia, Cardioecia, Nematifera, Brachysoecia, Notoplagioecia, Stathmepora, Plethoporella, Cartecytis, Diplodesmopora, Lobosoecia, Cyclocites, Ripisoecia, Grammecava, Psilosolen, Grammascosoecia, Grammanotosoecia.*

New species: *Oncousoecia accumulata, Atractosoecia walfordiana, Mecynoecia gracilis, M. obesa, M. stipata, Trigonoecia transversa, Microecia denisi, Brachysoecia convexa, Bisidmonea? globuloecia, Notoplagioecia farringdonensis, N. magnipora, Diaperoecia turonica, D. saillans, D. punctata, D. transversata, D. compressa, Diplosolen entalophoroidea, Platonea scalaria, P. hirsuta, Diplodesmopora alternata, D. opposita, Truncatula discoidea, T. vendocinensis, Cyclocites primogenitum, Leiosoecia occlusa, Ditaxia parvipora, Chilopora cretacea, Tretocycloecia sabaudica, Psilosolen capitiferax, Grammascosoecia porosa, G. parvipora, Grammanotosoecia contorta, Polyascosoeicia coronopus, Reteporidea collardeti, R. subramosa.*

Casanowicz, I. M. Parsee religious ceremonial objects in the United States National Museum. No. 2432. May 3, 1922[1] 1-16

Chamberlin, Ralph V. Notes on West Indian millipeds. No. 2431. July 6, 1922[1] 1-19

New family: Epinannolenidae.

New suborder: Epinannolenoidea.

New genera: *Cubocricus, Ricodesmus.*

New species: *Prostemmiulus nesides, Nesobolus yaterus, N. libanonus, Cubobolus cinchonanus, Microspirobolus cremus, M. mimus, M. richmondi, Amphelictogon dolius, A. pinetorum, Ricodesmus stejnegeri, Cyclodesmus pinetorum.*

Cushman, R. A. On the Ashmead manuscript species of Ichneumonidae of Mrs. Slosson's Mount Washington lists. No. 2429. May 22, 1922[1] 1-30

---

[1] Date of publication.

Page

New genus: Protarchoides.

New species: *Adelognathus americanus, Lymeon? testaceipes, Exochus alpinus, Aperiletus clypeatus, A. delicatus, Plectiscus parvus, Megastylus ashmeadi, Atractodes ashmeadi, A. grandis, A. serpedontus, Barycnemis slossonae, Phygadeuon slossonae, Parabates monticola, Cymodusa coxalis, Polyaulon compressum, Diocles alticola, Plesignathus americanus, Euceros albomarginatus, Exochus alpinus, E. mandibularis, Hemiteles* (*Isdromas*) *washingtonensis, Syrphoctonus vertebratus, Homaspis slossonae, Hypoleptus monticola, Lymeon testaceipes, Megastylus ashmeadi, Nythobia minuta, Parabates monticola, Cymodusa coxalis, Stenomacrus alticola, Phygadeuon slossonae, Plectiscus parvus, Plesignathus americanus, Polyaulon compressum, Exochus mandibularis, Aperileptus delicatus, Protarchoides longipes, Scopesis monticola, Euceros albomarginatus, Stenomacrus alticola, Hemiteles* (*Isdromas*) *washingtonensis, Syrphoctonus vertebratus, Adelognathus americanus, Dioctes alticola, Nythobia minuta.*

New names. *Adelognathus persimilis, Thersilochus provancheri.*

Felt, E. P. A new cecidomyiid parasite of the white fly. No. 2444. November 2, 1922 [1] 1-2

New genus: *Cleodiplosis.*

New species: *Cleodiplosis aleyrodici.*

Fisher, W. S. New Buprestid beetles from Borneo and the Philippine Islands. No. 2428. April 28, 1922 [1] 1-18

New genus: *Cyalithoides.*

New species: *Phrixia albomaculata, Neoptosima picea, Cyalithoides fulgida, Chrysobothris gloriosa, Belionota obscuripennis, B. rubriventris, Philanthaxia obscura, P. elongata, P. cyanescens, Anthaxia attenuata, A. mindanaoensis, Coraebus cyaneoviridis, Sambus philippinus, Neosambus cyaneus, Toxoscelus acutipennis.*

New variety: *Chrysochroa fulminans*, var. *cobaltina.*

Gahan, A. B. Descriptions of miscellaneous new reared parasitic hymenoptera. No. 2445. May 25, 1922 [1] ... 1-24

New species: *Rogas hyphantriae, Microbracon caulicola, M. papaipemae, Gelis microplitidis, Podagrion crassiclava, Harmolita lolii, Polyscelis modestus, Anastatus microcentri, Calosoter metallicus, Coccophagus saissetiae, Ardalus antillarum, Telenomus* (*Prophanurus*) *busseolae.*

Gilmore, Charles W. The smallest known horned dinosaur Brachyceratops. No. 2424. April 24, 1922 [1] 1-4

Hay, Oliver P. Description of a new fossil sea cow from Florida, Metaxytherium floridanum. No. 2438. May 3, 1922 [1] 1-4

New species: *Metaxytherium floridanum.*

Kellogg, Remington. Description of the skull of Megaptera miocaena, a fossil humpback whale from the Miocene diatomaceous earth of Lompoc, California. No. 2435. July 3, 1922 [1] 1-18

New species: *Megaptera miocaena*

---

[1] Date of publication.

Page.

LINTON, EDWIN. A new cestode from the maneater and mackerel sharks. No. 2433. May 25, 1922[1] 1–16

New species: *Phyllobothrium tumidum*.

MANN, WILLIAM M. Ants from Honduras and Guatemala. No. 2434. June 14, 1922[1] 1–54

New genus: *Opisthoscyphus*.

New species: *Cerapachys (Parasyscia) hondurianus, Thaumatomyrmex ferox, Opisthoscyphus scabrosus, Proceratium mancum, Euponera (Trachymesopus) cauta, Ponera perplexa, Belonopelta (Belonopelta) deletrix, Leptogenys (Leptogenys) gagates, L. (L.) donisthorpei, L. (Lobopelta) honduriana, L. (L.) rufa, L. (L.) imperatrix, Anochetus (Anochetus) minans, Eciton (Acamatus) impudens, Stenamma diversum, S. felixi, Aphaenogaster (Deromyrma), honduriana, Pheidole (Elasmopheidole) hondurensis, P. walkeri, Macromischa scandens, Rogeria? belti, R. inermis, Acanthognathus lentus, Strumigenys (Strumigenys) ludia, S. (S.) emeryi, S. brevicornis, Rhopalothrix (Rhopalothrix) amoena, R. (R.) gravis, R. (Octostruma) barberi, R. O. wheeleri, Cyphomyrmex, costatus, Myrmicocrypta cucumis, M. ednaella, Sericomyrmex opulenta, Apterostigma abdita, Acropyga (Rhizomyrma) wheeleri.*

New subgenus: *Megalomyrmex (Wheelerimyrmex), Belonopelta (Simopelta).*

New subspecies. *Odontomachus haematoda, subspecies dulcis.*

New variety: *Camponotus (Myrmorhachis) quadrilaterus, var. hondurianus.*

MARSHALL, WILLIAM B. New pearly fresh water mussels from South America. No. 2437. April 28, 1922[1] ... 1–9

New genus: *Diplodontites.*

New species: *Diplodontites cookei, Diplodon subcylindricus, D. subquadratus, D. arcuatus, D. trivialoides, Anodontites pittieri, A. colombiensis, Monocondylaea felipponei.*

MERRILL, GEORGE P. On meteoric irons from Alpine, Brewster County, Texas, and Signal Mountain, Lower California, and a pallasite from Cold Bay, Alaska. No. 2425. April 25, 1922[1] 1–4

MIDDLETON, WILLIAM. Descriptions of some North American sawfly larvae. No. 2442. May 12, 1922[1] 1–31

MUESEBECK, C. F. W. A Revision of the North American Ichneumon-flies belonging to the subfamilies Neoneurinae and Microgasterinae. No. 2436. August 5, 1922[1] 1–15

New species: *Mirax texana, Adelius nigripectus, A coloradensis, Apanteles caudatus, A. alypiae, A. olenidis, A. mimoristae, Microgaster ecdytolophae, M. bakeri, M. schizurae, M. harnedi, M. pantographae, M. swammerdamiae, M. canadensis, M. femoralis, M. phthorimaeae, Microplitis stigmaticus, M. rugosus, M. coloradensis, M. perplexus, M. kewleyi, M. autographae, M. longicaudus, M. nigritus, M. brassicae, M. plutellae, M. feltiae, M. latistigmus, M striatus, M. scutellatus, M. laticinctus, M. confusus, M. bradleyi, M. montanus.*

---

[1] Date of publication.

Page.

SNYDER, THOMAS E. New termites from Hawaii, Central and South America, and the Antilles. No. 2441. May 25, 1922[1] 1–32

New species. *Kalotermes immigrans*, *K. montanus*, *K. tuberculifrons*, *K. cubanus*, *Neotermes connexus*, *Cryptotermes rospigliosi*, *C. piceatus*, *C. thompsonae*, *Coptotermes niger*, *C. crassus*, *Armitermes intermedius*, *Constrictotermes (Tenuirostritermes) incisus*, *C. (T.) briciae*, *Anoplotermes gracilis*, *A. manni*.

New variety: *Neotermes connexus*, var. *major*.

SPRINGER, FRANK. Crinoids from the Upper Cretaceous of Tamaulipas, Mexico. No. 2426. April 25, 1922[1] 1–4

New species: *Balanocrinus mexicanus*.

STEPHENSON, L. W. Some Upper Cretaceous shells of the rudistid group from Tamaulipas, Mexico. No. 2422. June 13, 1922[1] 1–28

New genus *Tampsia*.

New species: *Tampsia bishopi*, *T. chocoyensis*, *Sauvagesia belti*, *S. coloradensis*, *Durania manuelensis*.

TIMBERLAKE, P. H. A revision of the Chalcid-flies of the Encyrtid genus Chrysoplatycerus. No. 2423. April 25, 1922[1] 1–10

New species: *Chrysoplatycerus ferrisi*.

VAN CLEAVE, H. J. A new genus of trematodes from the white bass. No. 2430. May 24, 1922[1] 1–8

New genus: *Allacanthochasmus*.

New species *Allacanthochasmus varius*.

WELD, CLARA JAMIESON. Studies on Chalcid-flies of the subfamily Leucospidinae, with descriptions of new species. No. 2427. June 28, 1922[1] 1–43

New species. *Leucospis slossonae*, *L. metallica*, *L. opalescens*, *L. elegans*, *L. fuliginosa*, *L. indiensis*, *L. banksi*, *L. ornatifrons*, *L. decorata*, *L. orientalis*, *L. maculata*, *L. bengalensis*, *L. robusta*, *Epexoclaenoides pyriformis*.

WELD, LEWIS H. Notes on American gallflies of the family Cynipidae producing galls on acorns, with descriptions of new species. No. 2440. June 28, 1922[1] 1–32

New species. *Callirhytis milleri*, *C. petrina*, *C. fructuosa*, *C. petrosa*, *C. lapillula*, *C. balanosa*, *C. carmelensis*, *C. middletoni*, *C. balanaspis*, *C. balanopsis*, *C. balanoides*, *Andricus fimbriatus*.

———. Notes on Cynipid wasps, with descriptions of new North American species. No. 2439. June 28, 1922[1] 1–29

New species: *Xystoteras poculum*, *Philonix gigas*, *Acraspis alaria*, *Callirhytis cryptica*, *C. flora*, *C. parva*.

---

[1] Date of publication.

LIST OF ILLUSTRATIONS.

PLATES.

Some Upper Cretaceous Shells of the Rudistid Group from Tamaulipas, Mexico.

By L. W Stephenson

Facing page.
1–4. *Tampsia bishopi* Stephenson 14
5–8. *Tampsia chocoyensis* Stephenson 14
9–10. *Sauvagesia degolyeri* Stanton? 14
11. *Sauvagesia belti* Stephenson 14
12–14 *Sauvagesia coloradensis* Stephenson 14
15. *Durania manuelensis* Stephenson 14

A Revision of the Chalcid-Flies of the Encyrtid Genus Chrysoplatycerus.

By P. H. Timberlake

1. Forewings of *Chrysoplatycerus ferrisi* Timberlake 10

The Smallest Known Horned Dinosaur Brachyceratops.

By Charles W Gilmore.

1. Mounted skeleton of *Brachyceratops montanensis*, viewed from the left side .. 4
2 Mounted skeleton of *Brachyceratops montanensis*, viewed from the right side.. 4
3. Mounted skeletons of *Brachyceratops* and *Triceratops*. 4
4. Restoration of *Brachyceratops montanensis* 4

On Meteoric Irons from Alpine, Brewster County, Texas, and Signal Mountain, Lower California, and a Pallasite from Cold Bay, Alaska.

By George P. Merrill.

1. Fig. 1. The Signal Mountain, Lower California, octahedrite, magnified 2½ diameters; showing in the upper left secondary granulation.... 4
2. The Alpine, Texas, ataxite. Polished surface magnified about 4 diameters 4
2. Fig. 1. The Cold Bay, Alaska, pallasite. Broken and polished surfaces. Enlarged about one-fourth 4
2. The Cold Bay, Alaska. Polished surface. Enlarged 2½ diameters.. 4

Crinoids from the Upper Cretaceous of Tamaulipas, Mexico.

By Frank Springer.

1. A new crinoid from the Upper Cretaceous of Mexico. 4

Studies on Chalcid-Flies of the Subfamily Leucospidinae, with Descriptions of New Species.

By Clara Jamieson Weld.

Facing page.
1. *Leucospis affinis* 42
2. Heads and hind femora of *Leucospidinae* 42
3. Abdomens of *Leucospidinae* 42
4. Details of *Leucospidinae* 42

A New genus of Trematodes from the White Bass.

By H. J. Van Cleave.

1. *Allacanthochasmus varius*, new species 8

Notes on West Indian Millipeds.

By Ralph Chamberlin.

1-6. West Indian millipeds 20

Parsee Religious Ceremonial Objects in the United States National Museum.

By I. M. Casanowicz.

1. Portrait of Zoroaster 3
2. Fire ladle (left), fire urn (center), fire tongs (right) 11
3. Offering tray 12
4. Ceremony of investiture with the sudra and kusti 13
5. Parsee gentleman, showing costume 14
6. Parsee mother and children, showing costumes 15
7. Tower of silence 16

A New Cestode from the Maneater and Mackerel Sharks

By Edwin Linton.

1-3. A new cestode, *Phyllobothrium tumidum* 16

Description of the Skull of Megaptera Miocaena, a Fossil Humpback Whale from the Miocene Diatomaceous Earth of Lompoc, California.

By Remington Kellogg.

1. Ventral view of skull of *Megaptera miocaena* 18
2. Outline drawing of ventral view of skull of *Megaptera miocaena* 18
3. Dorsal view of skull of *Megaptera miocaena* 18
4. Lateral view of skull of *Megaptera miocaena* 18

A Revision of the North American Ichneumon-flies Belonging to the Subfamilies Neoneurinae and Microgasterinae.

By C. F. W. Muesebeck.

1. North American ichneumon-flies 74

New Pearly Fresh Water Mussels from South America.

By William B. Marshall.

1-3. South American fresh-water mussels 10

DESCRIPTION OF A NEW FOSSIL SEA COW FROM FLORIDA, METAXYTHERIUM FLORIDANUM.

By Oliver P. Hay.

Facing page.
1. *Metaxytherium floridanum*, new species.................................... 4

NOTES ON CYNIPID WASPS, WITH DESCRIPTIONS OF NEW NORTH AMERICAN SPECIES.

By Lewis H. Weld.

1. *Ibalia maculipennis* Haldeman. Female, male, larvae, pupae............. 2

NOTES ON AMERICAN GALLFLIES OF THE FAMILY CYNIPIDAE PRODUCING GALLS ON ACORNS, WITH DESCRIPTIONS OF NEW SPECIES.

By Lewis H. Weld.

1-5. Gallflies of the family Cynipidae.................................... 30

NEW TERMITES FROM HAWAII, CENTRAL AND SOUTH AMERICA, AND THE ANTILLES.

Thomas E. Snyder.

1. New species of *Kalotermes* and *Armitermes*.......................... 32
2. A new *Cryptotermes* with front of pronotum serrate in soldier caste........ 32
3. Two new striking species of *Constrictotermes* with perconstricted heads.... 32
4. Wing venation of Kalotermitidae.. 32
5. Wing venation of Kalotermitidae and Termitidae......................... 32

STUDIES ON THE CYCLOSTOMATOUS BRYOZOA.

By Ferdinand Canu and Ray S. Bassler.

1-28. Fossil and recent Cyclostomatous Bryozoa............................ 154

DESCRIPTIONS OF MISCELLANEOUS NEW REARED PARASITIC HYMENOPTERA.

By A. B. Gahan.

1. New reared parasitic hymenoptera....................................... 24

TEXT FIGURES.

A REVISION OF THE CHALCID-FLIES OF THE ENCYRTID GENUS CHRYSOPLATYCERUS.

By P. H. Timberlake.

Page.
1. Antenna of female of *Chrysoplatycerus ferrisi* Timberlake.................. 6
2. Antenna of male *Chrysoplatycerous ferrisi* Timberlake..................... 9

STUDIES ON CHALCID-FLIES OF THE SUBFAMILY LEUCOSPIDINAE, WITH DESCRIPTIONS OF NEW SPECIES.

By Clara Jamieson Weld.

1. Diagrams of pronotum of *Leucospis*. *a*, *cayennensis*, without any carina; *b*, *affinis*, with one carina; *c guzeratensis*, with two carinae................ 5
2. Diagrams of scutellum, metanotum, and propodeum of *Leucospis*, viewed from above and in profile. *a* and *b*, *L. metallica; c* and *d*, *L. robertsoni; e* and *f*, *gigas; g* and *h*, *affinis* 6

Page.

A NEW GENUS OF TREMATODES FROM THE WHITE BASS.

By H. J. Van Cleave.

1. Series of outline drawings, all to same scale showing relative size and body form of individuals of *Allacanthochasmus varius.* Relative position of acetabulum and two testes shown in each drawing 3
2. Details of structure of *Allacanthochasmus varius.* The uterus is completely filled with eggs, but for convenience in this drawing is shown in flat stippling. Vitellaria of dorsal intercecal region have been omitted, as have also the cuticular spines. The scale accompanying the drawing has the relative value of 0.1 mm.. 4

ANTS FROM HUNDURAS AND GUATEMALA.

By William M. Mann.

1. *Thaumatomyrmex ferox*, new species. Head of worker.................... 3
2. *Opisthoscyphus scabrosus*, new species. Head of worker.................. 5
3. *Opisthoscyphus scabrosus*, new species. Lateral view of worker........... 5
4. *Belonopelta* (*Belonopelta*) *deletrix*, new species, Head of worker.......... 10
5. *Leptogenys* (*Leptongenys gagates*, new species. Head of worker........... 11
6. *Leptogenys* (*Leptogenys donisthorpei*, new species. Head of worker....... 12
7. *Leptogenys* (*Lobopelta*) *honduriana*, new species. *a*, head of worker; *b*, thorax and petiole.. 13
8. *Leptogenys* (*Lobopelta*) *imperatrix*, new species. Worker. *a*, thorax and petiole; *b*, head; *c*, petiole from above.............................. 16
9. *Eciton* (*Acamatus*) *impudens*, new species. Worker..................... 19
10. *Stenamma felixi*, new species. Worker. *a*, head; *b*, thorax and abdomen.. 22
11. *Aphaenogaster* (*Demomyrma*) *honduriana*, new species. Worker........... 24
12. *Pheidole* (*Elasmopheidole*) *hondurensis*, new species. Soldier. *a*, head; *b*, thorax and petiole.. 25
13. *Pheidole walkeri*, new species. Soldier. *a*, head; *b*, head, thorax, and petiole.. 27
14. *Macromischa scandens*, new species. Worker........................... 30
15. *Rogeria inermis*, new species.. 32
16. *Acanthognathus lentus*, new species. Head of worker.................... 34
17. *Strumigenys* (*Strumigenys*) *ludia*, new species. Head of worker....... 36
18. *Strumigenys* (*Strumigenys*) *emeryi*. Head of worker...................... 37
19. *Rhopalothrix* (*Rhopalothrix*) *gravis*, new species. Worker. *a*, head; *b*, thorax and petiole. (Only the larger hairs are shown)................. 40
20. *Myrmecocrypta ednaella*, new species. Worker. *a*, head; *b*, thorax and petiole.. 47
21. *Sericomyrmex opulenta*, new species. Worker. *a*, head; *b*, thorax and petiole.. 48
22. *Apterostigma abdita*. Thorax and petiole of worker..................... 50

DESCRIPTION OF THE SKULL OF MEGAPTERA MIOCAENA, A FOSSIL HUMPBACK WHALE FROM THE MIOCENE DIATOMACEOUS EARTH OF LOMPOC, CALIFORNIA.

By Remington Kellogg.

1. Dorsal view of right periotic of *Megaptera miocaena* × 1, Cat. No. 10300, U. S. N. M.; Lompoc, California.. 10
2. Posterior view of left periotic of *Megaptera nodosa* × 1, Cat. No. 21492, U. S. N. M.; Cape Cod, Mass.. 11

Page.
3. Ventral view of right periotic of *Megaptera miocaena* × 1, Cat. No. 10300, U.S.N.M.; Lompoc, California.......... 12
4. Ventral view of left periotic of *Megaptera nodosa* × 1, Cat. No. 21492, U.S.N.M.; Cape Cod, Massachusetts.......... 13
5. Posterior view of right tympanic and periotic of *Megaptera miocaena* in position × 1, Cat. No. 10300, U.S.N.M.; Lompoc, California.......... 14
6. Looking into the vestibule from apex of right periotic of *Megaptera miocaena* × 1, Cat. No. 10300, U.S.N.M.; Lompoc, California.......... 14
7. Posterior view of right periotic of *Megaptera miocaena* × 1, Cat. No. 10300, U.S.N.M.; Lompoc, California.......... 15
8. External view of left tympanic of *Megaptera miocaena*, about natural size, Cat. No. 10300, U.S.N.M.; Lompoc, California.......... 15
9. Dorsal view of left tympanic of *Megaptera miocaena*, about natural size, Cat. No. 10300, U. S.N.M.; Lompoc, California.......... 16
10. Internal view of left tympanic of *Megaptera miocaena*, about natural size, Cat. No. 10300, U.S.N.M.; Lompoc, California.......... 16

NOTES ON CYNIPID WASPS, WITH DESCRIPTIONS OF NEW NORTH AMERICAN SPECIES.

By Lewis H. Weld.

1. *Ibalia maculipennis* Haldeman. Frequency distribution graphs showing size of 200 males and 280 females. The full and long dotted lines from observed data; the dots and crosses after graduating the ordinates...... 5
2. *Philonix gigas*, new species. Hypopygium and mesonotum.......... 11
3. *Acraspis pezomachoides* (Osten Sacken). Dorsal and side views of mesonotum and hypopygium.......... 11

NOTES ON AMERICAN GALLFLIES OF THE FAMILY CYNIPIDAE PRODUCING GALLS ON ACORNS, WITH DESCRIPTIONS OF NEW SPECIES.

By Lewis H. Weld.

1. *Biorhitza eldoradensis* (Beutenmueller). Cells in acorns of *wislizeni* (two on left) and *agrifolia* (on right). × 1.......... 7
2. *Callirhytis milleri*, new species. Cells in acorns of *agrifolia* × 1.......... 12
3. *Callirhytis lapillula*, new species. Cells in acorns of *bicolor* × 1.......... 19

NEW TERMITES FROM HAWAII, CENTRAL AND SOUTH AMERICA, AND THE ANTILLES.

By Thomas E. Snyder.

1. *Kalotermes cubanus*. Soldier. Ventral view of head, showing gula. Greatly enlarged.......... 7
2. *Kalotermes cubanus*. Soldier. Hind femur. Greatly enlarged.......... 8
3. *Neotermes connexus*. Soldier. Ventral view of head, showing gula. Greatly enlarged.......... 10
4. *Neotermes connexus*. Soldier. Hind femur. Greatly enlarged.......... 10
5. *Coptotermes niger*. Soldier. Ventral view of head showing gula. Greatly enlarged.......... 20
6. *Coptotermes crassus*. Soldier. Ventral view of head, showing gula. Greatly enlarged.......... 21

Page.

DESCRIPTIONS OF SOME NORTH AMERICAN SAWFLY LARVAE.

By William Middleton.

1. *Periclista hicoriae* Rohwer. *a*, maxilla; *b*, third urite 3
2. *Periclista similaris* Rohwer. *a*, maxilla; *b*, third urite 5
3. *Macrophya epinota* Say. *a*, maxilla; *b*, antenna; *c*, third urite 7
4. *Pseudosiobla floridana* Ashmead. *a*, maxilla; *b*, third urite 12
5. *Pteronidea amelanchieridis* Rohwer. Maxilla 17
6. *Pteronidea winnanae* Rohwer. Maxilla 18
7. *Pteronidea mendicana* Rohwer. *a*, third urite; *b*, antenna 20
8. *Acordulecera foveata* Rohwer. *a*, maxilla; *b*, antenna; *c*, third urite 29

STUDIES ON THE CYCLOSTOMATOUS BRYOZOA.

By Ferdinand Canu and Ray S. Bassler.

1. *Oncousoecia accumulata*, new species 7
2. *Macroecia lamellosa* Michelin, 1846 9
3. *Brachysoecia convexa*, new species 23
4. *Bisidmonea tetragona* Lamouroux 25
5. *Cavaria pustulosa* Hagenow, 1851 33
6. *Cea* (*Filicea*) *regularis* D'Orbigny, 1852 36
7. *Laterocea simplex* D'Orbigny, 1852 38
8. *Stathmepora gabbiana*, Ulrich and Bassler, 1907 40
9. *Tennysonia stellata* Busk, 1867 51
10. *Cyrtopora elegans* Hagenow, 1851 54
11. *Osculipora repens* Hagenow, 1851 58
12. *Truncatula pinnata* Roemer, 1840 65
13. *Truncatula tetragona* Michelin, 1846, and *T. subpinnata* D'Orbigny, 1854 67
14. *Truncatula vendocinensis*, new species 70
15. *Discocytis eudesi* Michelin, 1844 71
16. *Semicytis disparilis* D'Orbigny, 1854 75
17. *Desmepora semicylindrica* Roemer, 1840, and *D. rugosa* D'Orbigny, 1854 78
18. Genus *Meliceritites* Roemer, 1840 86
19. *Cyclocites primogenitum*, new species 89
20. *Ceriocava corymbosa* Lamouroux, 1821 91
21. *Spiroclausa spiralis* Goldfuss, 1827 93
22. *Spiroclausa spiralis* Goldfuss, 1827 93
23. *Ripisoecia conifera* Lamouroux, 1821 95
24. *Grammecava dumetosa* Defrance, 1824 96
25. *Haplooecia straminea* Phillips, 1829 98
26. *Leiosoecia constantii* D'Orbigny, 1850 99
27. *Ditaxia anomalopora* Goldfuss, 1827 102
28. *Ditaxia parvipora*, new species 104
29. *Chilopora guernoni* Haime, 1854 106
30. *Chilopora cretacea*, new species 107
31. *Tretocycloecia dichotoma* Reuss, 1847 109
32. *Alveolaria semiovata* Busk, 1859 111
33. *Parascosoecia cicatrix* Gregory, 1899 114
34. Genus *Crisina* D'Orbigny, 1852 117
35. *Grammascosoecia dichotoma* Goldfuss, 1827 120
36. *Grammascosoecia porosa*, new species 122
37. Genus *Polyascosoecia* Canu and Bassler, 1920 125
38. Genus *Reteporidea* D'Orbigny, 1852 130
39. *Sulcocava cristata* D'Orbigny, 1854 135
40. *Filicrisina verticillata* D'Orbigny, 1852 136

SOME UPPER CRETACEOUS SHELLS OF THE RUDISTID GROUP FROM TAMAULIPAS, MEXICO.

By L. W. Stephenson,
Of the United States Geological Survey.

OCCURRENCE.

In March, 1920, the writer, while in the employ of the Mexican Gulf Oil Co. (through the courtesy of whose officials this paper is now published), discovered a few rudistids, representing several species, associated with several other invertebrate species, in strata of Upper Cretaceous age on two American-owned haciendas known, respectively, as Chocoy and Las Flores (or Manuel), on the line of the National Railways of Mexico between Tampico and Monterrey, in the State of Tamaulipas, Mexico. Chocoy is owned by Mr. A. W. Beckley, of Tampico, and Chocoy station is about 71 kilometers northwest of Tampico. Las Flores is owned by Smith, Newell, and Bishop, of Tampico, and Manuel station is 81 kilometers northwest of Tampico.

Subsequent to my first visit to these haciendas additional discoveries of rudistids and a few other invertebrates were made on Las Flores hacienda by Mr. R. A. Bishop and on Chocoy hacienda by Mr. Beckley and myself, as explained on subsequent pages. It is my pleasure at this place to express my appreciation to the owners of these properties for the courtesies which they extended to me on the occasion of each of these visits.

Two specimens of rudistids belonging to separate genera, found on Chocoy hacienda in 1919 by Messrs. A. E. Fath and Eugene Stebinger, have been kindly placed at the writer's disposal, and one of the specimens has been made the type of the new species *Sauvagesia coloradensis.*

The fossils were found in part in the uppermost beds of the San Felipe formation, which is brought to the surface in this area by broad anticlinal folds, and in part in the overlying Mendez formation. The San Felipe formation consists of 700 or 800 feet (200–250 meters) of regularly bedded platy limestone with subordinate interbedded seams and thin layers of calcareous shale, there being, however, some thicker bedded layers of shale in the upper part of the formation. The Mendez formation conformably overlies the San Felipe formation, and in this part of Mexico consists of about 800 feet (250 meters) of calcareous shale or marl ranging in color from gray or greenish gray through pale pink to rather strong red. The thickest and most persistent bands of red are in the upper part of the shale. The dividing line between the Mendez shale and the underlying San Felipe limestone has been arbitrarily taken to be the top of the uppermost layer of limestone, but there are some rather thick layers of Mendez-like shale interbedded with thinner beds of limestone below this uppermost limestone layer. The Mendez shale is uncomformably overlain in the easternmost part of Chocoy hacienda by marine strata of Tertiary age.

The topography in the vicinity of Manuel and Chocoy stations is rather strongly rolling and prairie-like, and the surface is drained by arroyos which are dry except during rainy periods. The fossiliferous outcrops examined were in the beds and banks of these arroyos, in gullies, and in railroad cuts. Most of the fossils collected on my first visit were found loose in the beds of the arroyos, but some of them contained attached portions of matrix, which showed them to have been derived from the shale and limestone cut by the arroyos, and some fragments of *Inoceramus* and *Ostrea* were found definitely in place in the shale. Subsequently Mr. Bishop found crinoid stems in place in layers of San Felipe limestone at two localities, and he also found in the Mendez shale the colony of rudistids described on pages 6 to 8 as *Tampsia bishopi.* Mr. Beckley and the writer also found the colony of rudistids described on pages 8, 9 as *Tampsia chocoyensis* virtually in place in the Mendez shale.

THE FOSSILS AND THEIR SIGNIFICANCE.

The fossils found in the upper part of the San Felipe formation on Las Flores and Chocoy haciendas include: Foraminifers; an organism whose zoological affinities have not yet been determined, perhaps a hydroid or a coral; stems of crinoids belonging to the genus *Balanocrinus* in the family Pentacrinidae; an undescribed brachiopod; numerous fragments of the shells of one or more large species of *Inoceramus; Ostrea plumosa* Morton; *Ostrea congesta* Conrad (?); representatives of the family Radiolitidae, including *Sauvagesia degolyeri* Stanton (?), *Durania manuelensis* Stephenson, and poorly preserved fragments probably representing several other species of *Sauvagesia.*

Outside of these haciendas fossils were found in the San Felipe limestone at two localities in the State of Tamaulipas. One of these was on the road leading from Ciudad Victoria eastward to Soledad, about 10 kilometers west of Soledad and 3 kilometers east of the crest of Tamaulipas range. The fossils were in a white, rather soft limestone and included fragments of a large species of *Inoceramus* comparable with *I. deformis* Meek; to these fragments were attached many small, irregular oysters which, though poorly preserved, have the general appearance of *Ostrea congesta* Conrad. The exact stratigraphic position of this fossil layer could not be determined, but it is probably not less than 200 or 300 feet (60 to 90 meters) below the top of the formation.

The second locality was at the village of Santa Isabel, 21 or 22 kilometers east of Forlon station on the National Railways of Mexico; this station is 167 kilometers northwest of Tampico. Numerous fragments of large *Inoceramus* shells with *Ostrea congesta* Conrad(?) attached and one poorly preserved rudistid were observed in characteristic San Felipe rocks composing a fence, the stones of which were obtained from outcrops of San Felipe limestone in the immediate vicinity of Santa Isabel; the stratigraphic position of these outcrops is thought to be about the middle of the formation.

The fossils found in the lower part of the Mendez shale include: Foraminifers; stems of crinoids of the genus *Balanocrinus;* echinoid spines; fragments of *Inoceramus; Ostrea plumosa* Morton; representatives of the family Radiolitidae, including *Sauvagesia belti* Stephenson and unidentified fragments of *Sauvagesia.*

The upper part of the Mendez yielded: Foraminifers; a few crinoid stems of the genus *Balanocrinus;* a few plates of an echinoid test; representatives of the family Radiolitidae, including *Tampsia bishopi* Stephenson, *T. chocoyensis* Stephenson, and *Sauvagesia coloradensis* Stephenson.

On the basis of the large fragments of *Inoceramus* and of *Ostrea congesta* Conrad (?), the San Felipe formation is correlated with the Austin chalk of Texas and with the Niobrara chalk of the western interior of the United States.

Ostrea plumosa Morton, which occurs in both the upper part of the San Felipe limestone and the lower part of the overlying Mendez shale, has a stratigraphic range in the Atlantic and Gulf Coastal Plain of the United States from the horizon of the upper part of the Austin chalk to the top of the Cretaceous.

Sauvagesia belti Stephenson, which is represented by one specimen from the lower part of the Mendez shale, is closely related to and perhaps specifically identical with a species of *Sauvagesia* that occurs in the Brownstown marl near White Cliffs, Arkansas. Since the Brownstown marl corresponds in age to the lower part of the type Taylor marl, *S. belti* affords a basis for regarding the Mendez shale as approximately equivalent to the Taylor marl.

So far as my present knowledge of the subject goes, the San Felipe limestone appears to correspond approximately in age to the San Juan limestone of Dumble.[1] The Mendez shale undoubtedly corresponds to at least a part of the Papagallos shale of Dumble, but there appear to me to be good reasons for believing that the Papagallos includes beds that are stratigraphically higher than the typical Mendez as it is developed in the southeastern part of the State of Tamaulipas.

Future critical study of the foraminifera which abound in both the San Felipe and Mendez formations will in my opinion result in the discrimination of faunal zones that will make possible a close correlation of these formations with beds of corresponding age in northern Mexico and in Texas. Inasmuch as the Mendez shale and the Taylor marl were laid down under similar conditions of deposition, a comparison of the foraminiferal faunas of these two formations ought to be particularly fruitful of results.

The crinoids from the upper part of the San Felipe formation and from the lower and upper parts of the Mendez shale are described and their significance discussed by Dr. Frank Springer in Article 5 of this volume of the Proceedings. The crinoid stems are all referred to the genus *Balanocrinus* in the family Pentacrinidae, and are described under the new specific name *B. mexicanus*.

DESCRIPTIONS OF NEW FORMS.

TAMPSIA, new genus.

The two forms described below under the specific names *Tampsia bishopi* and *T. chocoyensis* present generic characters which apparently have not been heretofore described. The lower valve is large, elongate, conical, and thick shelled. In both species the close crowding of the individuals in the colonies has caused irregularities of growth and coarse scars and imperfections of greater or less size. The shell structure of the outer shell layer, which alone is preserved, is very fine as compared with that of the genera *Sauvagesia* and *Durania*, and the polished cross section exhibits numerous fine, continuous, concentric growth lines. These growth lines inclose rows of small cells which vary greatly in size and shape due to the irregularities of growth; many of the cells are squarish or rectangular, but some of them are irregular in shape and are five or six sided. (See pl. 3, fig. 2, and pl. 4.)

There is no internal ligamental ridge, nor is there any trace in the cell structure of a feature corresponding to this ridge. The inner shell layer had entirely disappeared before fossilization, so that no trace remains of the hinge mechanism, adductor scars, or other internal features; with the inner shell layer gone the interior of the lower valve, after the removal of the matrix, is a nearly circular cavity which gradually decreases in diameter from above downward.

---

[1] Dumble, E. T., Geology of the northern end of the Tampico embayment area: Proc. Cal. Acad. Sciences, vol. 8, No. 4, pp. 125–133, 1918.

The upper rim of the shell into which the uper valve fits is steeply inclined, forming a flaring aperture; the surface of the rim is slightly undulating and bears a few faint impressions of radial vessels, some of which are branching; these are spaced 5 to 20 mm. apart; this surface is also covered with numerous very fine, faint, radiating striæ, and portions of the surface are finely pitted; the inner margin of the rim is bordered by a slightly raised sharp ridge which is closely paralleled by a narrow channel.

The outer surface of the shell bears two siphonal channels (E and S, pl. 1), which vary somewhat in character on different individuals in the two species described in this paper. Where the incremental lines cross these channels they bend downward toward the base of the shell.

The anterior siphonal channel is shallow and is marked along the bottom throughout its length by the trace of a narrow sinus which, in the form of a closely pressed slit, cuts back through the shell at right angles to the surface, extending to within 3 or 4 mm. of the inner surface (pl. 4, *a*); this is a line of weakness along which the shell easily breaks and splits apart (see pl. 8, *a*); the sinus is sometimes a little open, admitting a thin seam of matrix. Where this sinus intercepts the upper rim of the shell it forms a distinct slit, generally slightly gaping, which is bordered by a narrow carina (pl. 2, *a*).

Both in front and behind the sinus the surface of the rim exhibits broad, shallow depressions, each of which is roughly a right-angle triangle with its base resting on the margin of the inner cavity of the shell. The two triangular areas are connected with each other by a flat uncarinated space between the inner end of the sinus and the inner margin of the shell (pl. 2). A polished cross section (pl. 4) shows that all the growth layers bend sharply inward as they approach this sinus. The hypotenuse of each of the triangular areas is also marked in the polished cross section by the disposition of the growth lines which along the trace of the triangle bend obliquely outward, due to the thinning or entire disappearance of the intermediate cells for a distance of 1 to several millimeters (pl. 4). This modification in the growth lines doubtless resulted from the contractile movements of the ventral siphon.

The upper rim of the shell between the posterior siphonal channel and the margin of the inner cavity is also marked by a bread, shallow depression which is, as a rule, less strongly impressed than the triangular depressions on either side of the sinus.

A sinus or slit cutting the shell along the bottom of the anterior siphonal channel in the manner just described, and depressions on the upper rim of the shell adjacent to the siphonal channels are features which, so far as I am aware, have not been found in any genus heretofore described. Perhaps the nearest approach to features of this kind is to be found in the genus *Lapeirousia.* This genus, according to the diagrams illustrating it,[a] bears two similar so-called pseudo-pillars forming a part of the inner wall of the outer shell layer and corresponding respectively to the two siphonal areas. Each of these pseudo-pillars is joined to the outer surface of the shell by a so-called suture, which is perhaps comparable to the slit or sinus in *Tampsia*, but *Tampsia* has only the one sinus and lacks the psuedo-pillars.

The genera *Biradiolites*, *Bournonia*, and *Durania*, which, like *Tampsia*, lack an internal ligamental ridge, present no features comparable to the sinus or slit *a* or the depressions on the upper rim of the shell adjacent to the siphonal areas.

Type of the genus.—*Tampsia bishopi* Stephenson.

TAMPSIA BISHOPI, new species.

Plates 1–4.

Discovery and occurrence.—This species is based upon a colony of rudistids discovered early in 1921 in reddish shale of the Mendez formation by Mr. R. A. Bishop, part owner and manager of Las Flores hacienda. On the basis of the rather pronounced red color of the shale containing the colony, it is believed to belong to the upper part of the Mendez, as that formation is developed in the southern part of the State of Tamaulipas; on this assumption the bed is 700 or 800 feet (200–250 meters) above the base of the Mendez. Since, however, the Mendez shale exhibits reddish bands at other lower levels, and only a relatively small thickness of the shale is exposed in this arroyo, the position of this bed in the upper part of the Mendez can scarcely be regarded as conclusively established. However, it is probably well above the middle of the formation.

Dr. John M. Muir, chief geologist of the Corona Oil Co., visited the locality in company with Mr. Bishop before the specimens were collected from the matrix, and he says that the largest part of the colony, the individuals of which still remain attached to each other, was standing upright in the shale, apparently in place. Smaller groups of attached individuals, separate individuals, and fragments had fallen down into the talus, and some fragments had even been washed out into the bed of the creek for a distance of a rod or two. Evidently there must have been 30 or more individuals in the colony before it was disturbed by erosion. Most of the material collected by Messrs. Bishop and Muir is shown artificially assembled in plate 3, figure 1; a few pieces had already been given away to interested persons before the photograph was taken. The locality was subsequently visited by Mr. Bishop and the writer, and a few additional fragments were found in the talus in the gully and in the bed of the adjacent arroyo.

---

[a] Douvillé, Henri. Études sur les Rudistes. Mem. de la Soc. Géol. de France, Paléontologie, No. 41, pp. 25–27, pl. 1, figs. 9–12, 1910.

The second largest group of attached individuals in the colony, shown in plate 1, is here designated the type of the species. It includes 6 moderately well preserved lower or right valves, none of which, however, is perfect. No upper valves were found. The material illustrated in plates 1, 2, 4, and figure 2 of plate 3 has been donated to the United States National Museum by Smith, Newell, and Bishop, the owners of Las Flores hacienda.

Description.—The lower valve is large, elongate, conical, nearly circular in cross section, slightly curved, slightly sinuous, or nearly straight, depending upon the position of growth. All the individuals in the colony are incomplete, a considerable portion of the lower ends of the lower valves having failed of preservation.

The dimensions of the largest lower valve in the group of type individuals are: Length, 270 mm.; diameter of upper end, 125 mm.; of lower end, 70 mm.; diameter of upper end of inner cavity, 65 mm.; of lower end of inner cavity, 35 mm.

The structural features which characterize the thick outer shell layer are included in the description of the genus on pages 4–6.

The outer surface of the shell is nearly smooth with the exception of distinct incremental lines, 15 or 16 weakly developed longitudinal ribs or undulations of irregular width, and two longitudinal siphonal channels separated by a prominent rib; the anterior siphonal channel (E) is shallow and narrow as compared with the broad deeply excavated posterior one (S); both the channels and the separating rib are simple, smooth undulations; some individuals are nearly smooth with the exception of the siphonal areas.

The posterior siphonal channel is a broad, even fold, and, though somewhat variable in strength on different individuals, is as a rule deeply excavated.

This species differs from *Tampsia chocoyensis* in the markedly smoother character of the outer shell surface and in the more deeply excavated, smoother, and more constant posterior siphonal channel.

Locality.—From an arroyo tributary to Arroyo el Capitán, on Las Flores hacienda about 9½ kilometers north of Manuel station, near the junction of the corners of haciendas Las Flores, Carrizal, and

Gonzalez, in the State of Tamaulipas, Mexico. Discovered by Mr. R. A. Bishop and collected by Messrs. Bishop and John M. Muir.

Type.—Donated to the United States National Museum by the firm of Smith, Newell, and Bishop, owners of Las Flores hacienda. Cat. No. 32499, U.S.N.M.

Geologic position.—Upper part of Mendez shale, which is an Upper Cretaceous formation corresponding in age approximately to the Taylor marl of Texas.

TAMPSIA CHOCOYENSIS, new species.

Plates 5–8.

Discovery and occurrence.—This species is based upon a colony of rudistids found in April, 1921, by A. W. Beckley and the writer in reddish shale in the upper part of the Mendez formation. The colony had been eroded from its position in the shale and was badly shattered. All the fragments that could be found were collected, and when as many of these as possible were fitted together they were found to include two attached lower valves, well preserved though incomplete at their lower extremities, and a dozen or more less complete lower valves and fragments. The two attached individuals (pl. 5) are here designated the type. A portion of the shell of one individual (pl. 8), perhaps belonging to this same colony, was found at this locality in 1919 by A. E. Fath and Eugene Stebinger.

Description.—In general form and in all the characters that may be regarded as generic this species is identical with that of *Tampsia bishopi.* The principal features which distinguish it from that species are (1) the coarser and rougher character of the growth lamellae, which tend to form irregular imbricating layers; (2) the sharper and somewhat stronger longitudinal undulations or ribs, which, however, are very irregular in their development; (3) the greater breadth of the anterior siphonal channel (E), the sides of which are also rougher and sometimes marked by faint longitudinal folds; and (4) the pronounced irregularity in the development of the posterior siphonal channel (S), which in some individuals is very shallow and in others is broken into a main and a subordinate channel by an intermediate rib. In one of the individuals of the type pair the bottom of the broad posterior siphonal channel is cut by a narrow, deep subordinate channel (pl. 6), in front of which is another narrow but shallow subordinate channel.

The largest of the two attached shells of the type pair exhibits the following maximum dimensions: Length, 200 mm.; diameter at top, 130 mm.; diameter at the incomplete bottom, 90 mm.; diameter of inner cavity, 63 mm. at top and 43 mm. at bottom.

Locality.—Found in red shale in a gully known as El Colorado, on Chocoy hacienda or ranch, 1½ kilometers northwest of Omaha station, near the northeast corner of fraction 101, about 64 kilometers northwest of Tampico, State of Tamaulipas, Mexico. Collected by A. W. Beckley and the writer.

Type.—Cat. No. 32500, U. S. N. M.

Geologic position.—Upper part of Mendez shale, an Upper Cretaceous formation corresponding in age approximately to the Taylor marl of Texas.

SAUVAGESIA DEGOLYERI Stanton (?).

Plates 9–10.

Sauvagesia degolyeri STANTON, Proc. U. S. Nat. Mus., vol. 59, No. 2379, pp. 453–454, pls. 96–97, 1921.

Description.—Fragments of Radiolitidae which closely resemble *Sauvagesia degolyeri* Stanton, recently described from the San Felipe formation near Puente Diablo between Valles and El Abra, in the eastern part of the State of San Luis Potosi, Mexico, were found by the writer in the upper part of the San Felipe formation at three localities on Las Flores hacienda and at one locality on Chocoy hacienda. These fragments exhibit numerous moderately rounded to rather sharp crested, irregularly developed longitudinal ribs separated by deep V-shaped channels, and the cell structure is very similar to that of *S. degolyeri.* The portion of the surface shown in plate 9, figure 1, is back of the posterior siphonal area.

On one incomplete young specimen, which was flattened by lateral compression before the internal cavity had an opportunity to become filled with matrix, the surface sculpture is preserved practically all the way around the shell (pl. 10); the anterior siphonal band E is somewhat distorted by the compression to which the shell was subjected, but it is flat, about 12 mm. wide, and marked by 6 or 7 small longitudinal ribs separated by deep, sharp channels a little narrower than the ribs; the posterior siphonal band (S) is also flat, 12 to 20 mm. wide, broadening upward, and is ornamented by 7 to 12 small ribs which increase in number from below upward by bifurcation; two ribs, a larger and a smaller, separated by deep V-shaped cavities occupy the area between the two siphonal bands.

The ligamental ridge (L) which characterizes the genus is clearly though imperfectly preserved on several of the fragments.

Owing to the poorly preserved condition of the ribs on Stanton's type specimen it is impossible to refer these fragments to his species with confidence. De Golyer states in the quotation given by Stanton that he found the type specimen in a bed 80 to 100 feet (25 to 30 meters) above the base of the San Felipe formation. I have recently visited the locality, and in my opinion the containing stratum is not in the lower part of the formation, but is above the middle, and is probably within 200 feet (60 meters) of the top of the formation. In other words, the stratigraphic position of the type is not very different from that of the fragments here described, a fact which lends strength to the assumption that the fragments represent the same species as the type.

The species is closely related to *Sauvagesia belti*, but differs from that species in the absence of minor ribbing on the major ribs.

Localities.—State of Tamaulipas, District del Sur: Las Flores hacienda (Manuel ranch), in an arroyo 3½ kilometers west by north of Manuel station (M. G. O. Acq. No. 135), in an arroyo 6 kilometers west by south of Manuel station (M. G. O. Acq. No. 138), and in an arroyo about 1½ kilometers west by south of Manuel station (M. G. O. Acq. No. 139); Chocoy hacienda or ranch, in an arroyo about 3 kilometers north-northwest of Chocoy station (M. G. O. Acq. No. 143).

Type.—The type specimen is in the United States National Museum at Washington as Cat. No. 32482.

Geologic position.—The specimens from Chocoy and Manuel haciendas occur in the upper part of the San Felipe formation, which is correlated approximately with the upper part of the typical Austin chalk in the vicinity of Austin, Texas.

SAUVAGESIA BELTI, new species.

Plate 11.

Occurrence.—This species is represented by one incomplete individual found by the writer near the railroad about 1½ kilometers northwest of Chocoy station. The specimen is a portion of the lower valve on the side opposite to that which bears the siphonal areas and includes less than half the circumference of the shell. The length of this fragment as preserved is 87 mm., and the shell flares from a width of about 20 mm. at the base to a width of 75 mm. on corresponding costae at the top.

The surface of the fragment is ornamented with 8 major costae which increase in size away from the base and which differ considerably in size; each of the major costae is ornamented with numerous minor irregular costae which differ somewhat in size from the base upward; the effect of complexity is further increased by a tendency of the growth layers to form imbricating lamellae.

The inner shell layer is not preserved. The outer shell layer is thick and exhibits the rather coarse cell structure which characterizes the genus; the ligamental ridge (L) is strongly developed though imperfectly preserved along the entire length of the shell; the inner surface of the shell is finely cancellated due to the crossing of the fine growth lines and a series of fine longitudinal lines.

The species is closely related to fragments of *Sauvagesia* found in the United States in the upper part of the Brownstown marl, just below the Annona tongue of Austin chalk, a mile northwest of White Cliffs, Sevier County, Arkansas. The latter represent an older stage of growth, but they exhibit minor ribbing on the major ribs, which strongly suggests specific identity.

The species is named in honor of Mr. Ben C. Belt, who was chief geologist of the Mexican Gulf Oil Co. at the time the fossils described in this paper were collected.

Locality.—In a gully on the west side of the track of the National Railways of Mexico, 1⅜ kilometers northwest of Chocoy station, about 72¾ kilometers northwest of Tampico (M. G. O. Acq. No. 141), State of Tamaulipas, Mexico.

Type.—Cat. No. 32504, U.S.N.M.

Geologic position.—Lower part of Mendez shale in beds which probably correspond approximately in age to the lower part of the Taylor marl in its type region in central Texas.

SAUVAGESIA COLORADENSIS, new species.

Plates 12–14.

Discovery and occurrence.—The specimen on which this species is based was found in 1919 by Messrs. A. E. Fath and Eugene Stebinger in reddish shale in the upper part of the Mendez formation, at the series of gullies 1½ kilometers northwest of Omaha station, known as El Colorado, where the colony of rudistids described on pages 8 and 9 as *Tampsia chocoyensis* was obtained.

Description.—The lower valve is large, elongate, thick shelled, and slightly curved. The specimen was apparently nearly circular in cross section, but the weaker side of the shell has been longitudinally crushed and is now nearly flat. Both the lower and upper ends are incomplete, having suffered fracture and partial destruction. The inner shell layer is wanting and the cavity is filled with red calcareous clay matrix containing many small foraminifers.

As preserved the dimensions of the shell are: Length, 155 mm.; diameter of upper end, 90 mm.; of lower end, 65 mm.; diameter of upper end of inner cavity, 58 mm.; of lower end of inner cavity, 40 mm.

The cell structure is only moderately coarse and in cross section the cells are partially arranged in rows roughly parallel to the undulations caused by the costate surface. The ligamental ridge (pl. 12, fig. 2, L) is prominently developed, projecting 4 to 6 mm. into the inner cavity; it is less than a millimeter thick except near its crest, where it flares to a thickness slightly exceeding a millimeter.

The surface of the shell has been somewhat marred by corrosion, and one side has been flattened by compression. Most of the features are, however, preserved well enough for description. The two siphonal bands are broad and shallow and are separated by a ribbed band about 20 mm. wide at the base and broadening to about 35 mm. at the top. The anterior siphonal area (E) forms a shallow channel broadening from a width of 17 mm. at the base to about 25 mm. at the top and is ornamented by 12 or more low, rounded, rather indistinct, irregular ribs. The posterior siphonal channel (S) is shallower, flatter, and a little narrower than the anterior one and is ornamented by 9 or 10 similar small ribs. The band between the siphonal areas exhibits two bordering rather prominent, though poorly preserved, ribs, separated by a deep, broadly flaring, V-shaped channel, on the front side of which is one subordinate rib and on both sides of which are fine indistinct longitudinal lines.

The rest of the surface of the shell is marked by about 12 unequal, angular, more or less prominent ribs, separated by rounded to angular channels, the sides of most of which are ornamented with several indistinct minor longitudinal ribs. The major ribs are largest on that part of the surface behind the posterior siphonal area and smallest on the half of the surface which lies in front of the anterior siphonal area.

Locality.—From gullies, known as El Colorado, on Chocoy hacienda, 1½ kilometers northwest of Omaha station, near the northeast corner of fraction 101, State of Tamaulipas, Mexico. Collected by Messrs. A. E. Fath and Eugene Stebinger.

Type.—Donated to the United States National Museum by the collectors, A. E. Fath and Eugene Stebinger. Cat. No. 32505, U.S.N.M.

Geologic position.—Upper part of Mendez shale, which is an Upper Cretaceous formation corresponding in age approximately to the Taylor marl of Texas.

DURANIA MANUELENSIS, new species.

Plate 15.

Description.—This species is based upon one relatively small, incomplete lower valve which is perhaps a young individual. Originally the shell was doubtless elongate, conical, and roughly circular in cross section; as preserved, however, it presents an elongated oval cross section due to mechanical compression. Only the outer shell layer is preserved, and the internal cavity left by the removal of the inner shell layer is filled with a calcareous shale matrix.

The cell structure is rather coarse, and the cells are polygonal and in cross section show only a slight tendency to form concentric rows; this is perhaps due to the fact that the growth layers were added almost horizontally one upon the other. The upper rim of the shell is nearly flat, though very slightly undulating, and bears faint, widely spaced impressions of radial vessels. A low, narrow carina bounds the inner margin of the rim. No ligamental ridge can be detected, for which reason the species is classed with the genus *Durania* rather than with *Sauvagesia.*

The exterior of the shell is marked by about a dozen major, broadly rounded, low longitudinal ribs of somewhat irregular width and by two siphonal areas; each of the major ribs bears 6 or 8 minor ribs, and the bottoms of the depressions between the major ribs is cut by a narrow, sharply defined channel.

The anterior siphonal area (E) is broad, flat, and scarcely excavated and is ornamented by about a dozen minor ribs. The posterior siphonal area (S) is only about half as wide as the anterior one, is deeply excavated, and bears 9 or 10 narrow, distinct ribs. The longitudinal band between the siphonal areas is also marked by minor ribs and is split by a central narrow, sharp channel. Over the entire outer surface the growth lines are fine, distinct, and sharply wavy where they cross the minor ribs.

Locality.—Found in an arroyo 3½ kilometers west by north of Manuel station (M. G. O. Acq. No. 135), which is about 81 kilometers northwest of Tampico, in the State of Tamaulipas, Mexico.

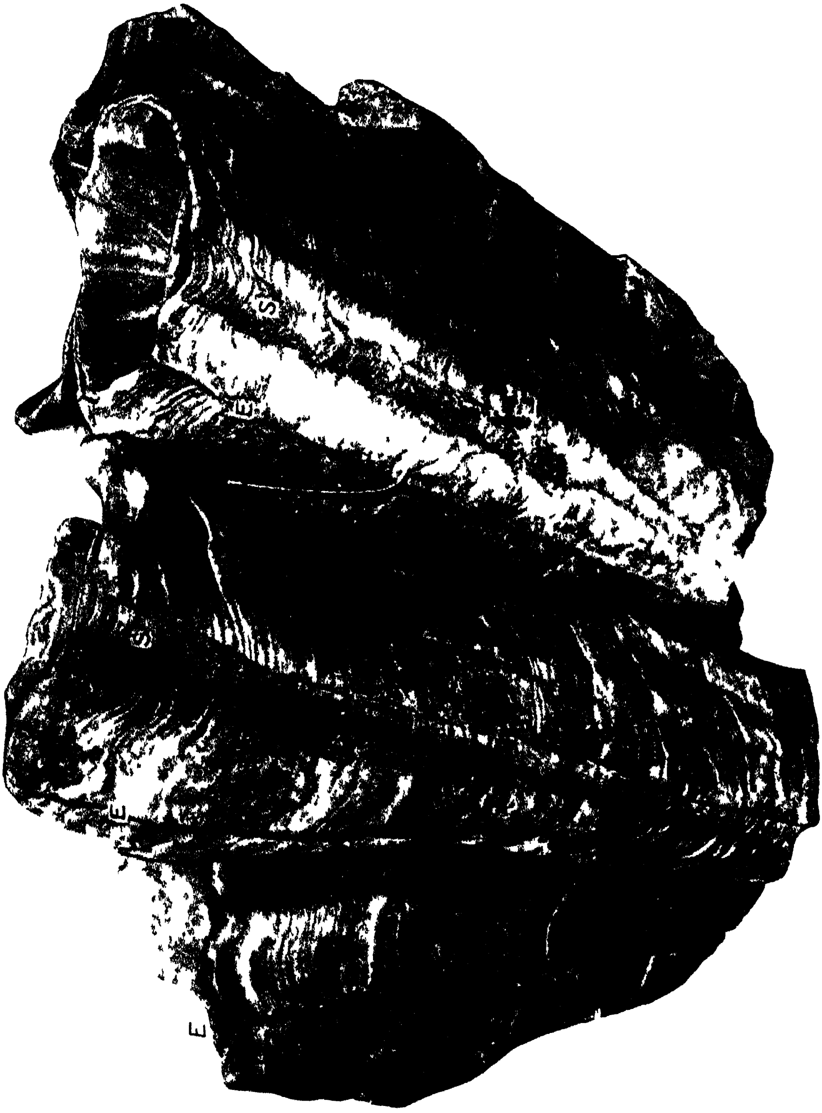
Type.—Cat. No. 32506, U.S.N.M.

Geologic position.—Upper part of San Felipe formation, corresponding in age approximately to the upper part of the type Austin chalk at Austin, Texas.

EXPLANATION OF PLATES.

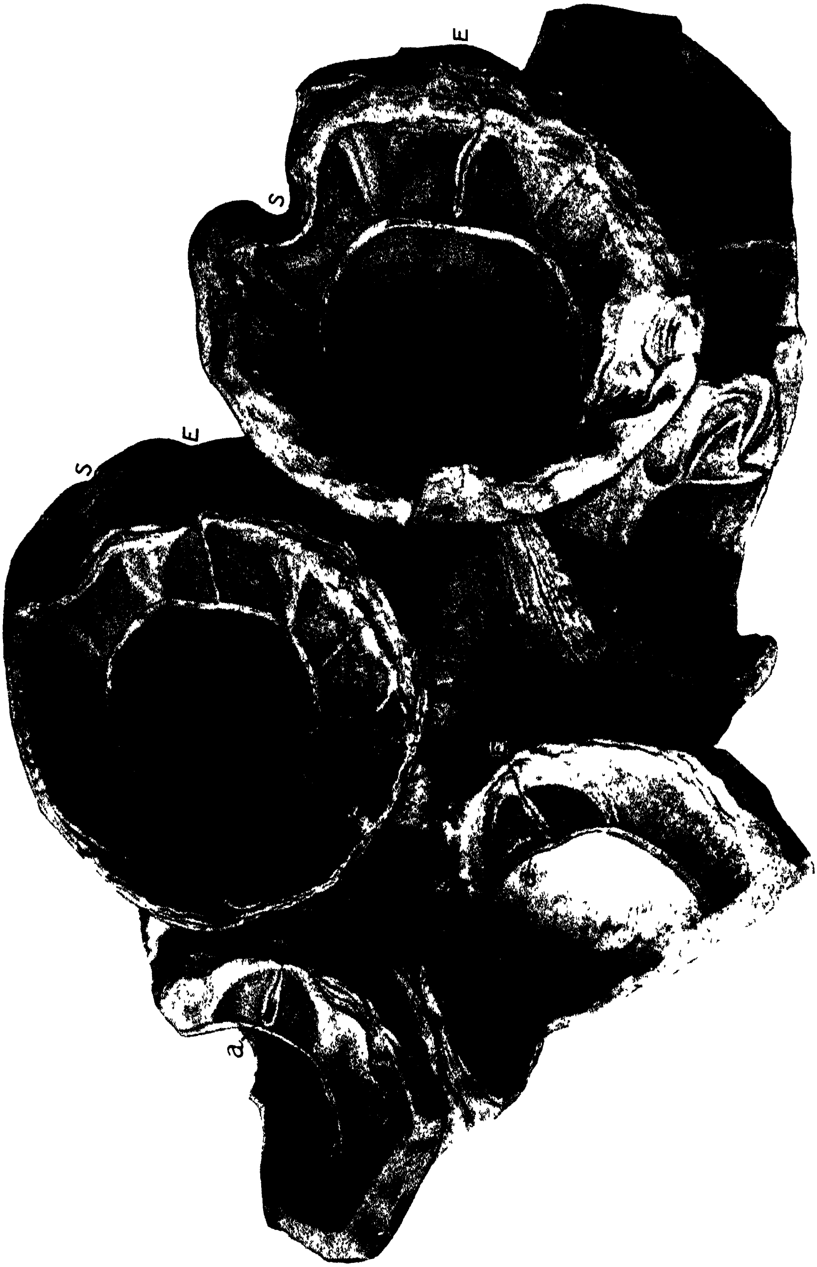
PLATE 1.

Tampsia bishopi Stephenson. Side view of the type group a little less than half natural size, from the upper part of the Mendez shale on Las Flores hacienda, 9½ kilometers north of Manuel station, State of Tamaulipas, Mexico. (E), shallow anterior siphonal channel, and the trace of a narrow sinus along its bottom. (S), posterior siphonal channel. Cat. No. 32499, U.S.N.M. Page 6.



TAMPSIA BISHOPI STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 14



TAMPSIA BISHOPI STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 15.

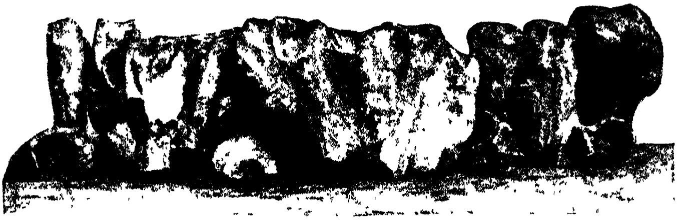
PLATE 2

Tampsia bishopi Stephenson. Top view of the type group of individuals, about eleven-twentieths natural size. Shows the features that characterize the upper rim of the lower valve, including the slit or sinus (*a*) which cuts into the shell along the anterior siphonal channel (E), the triangular depressions which border the slit on either side, the broad, shallow depression between the edge of the posterior siphonal notch (S) and the margin of the inner cavity, and the impressions of the radial vessels. Cat. No. 32499, U.S.N.M. Page 6.

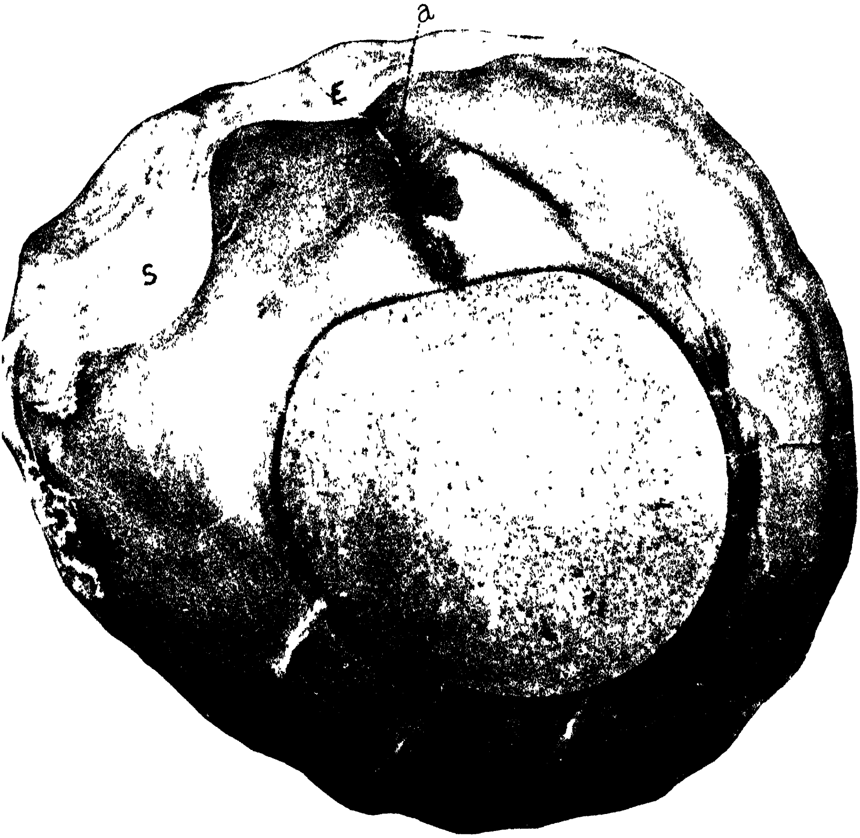
PLATE 3

FIG. 1. Most of the material composing the type colony of *Tampsia bishopi*, artificially assembled, about three-fortieths natural size. Several individuals of the colony had already passed into other hands when the picture was taken. Page 6.

FIG. 2. *Tampsia bishopi* Stephenson. Cross section of one of the loose individuals of the type colony, slightly enlarged, showing the notches of the siphonal channels (E) and (S); the slit or sinus (a) which cuts into and nearly through the shell along the bottom of the anterior siphonal channel, and the fine wavy growth lines. Cat. No. 32499, U.S.N.M. Page 6.



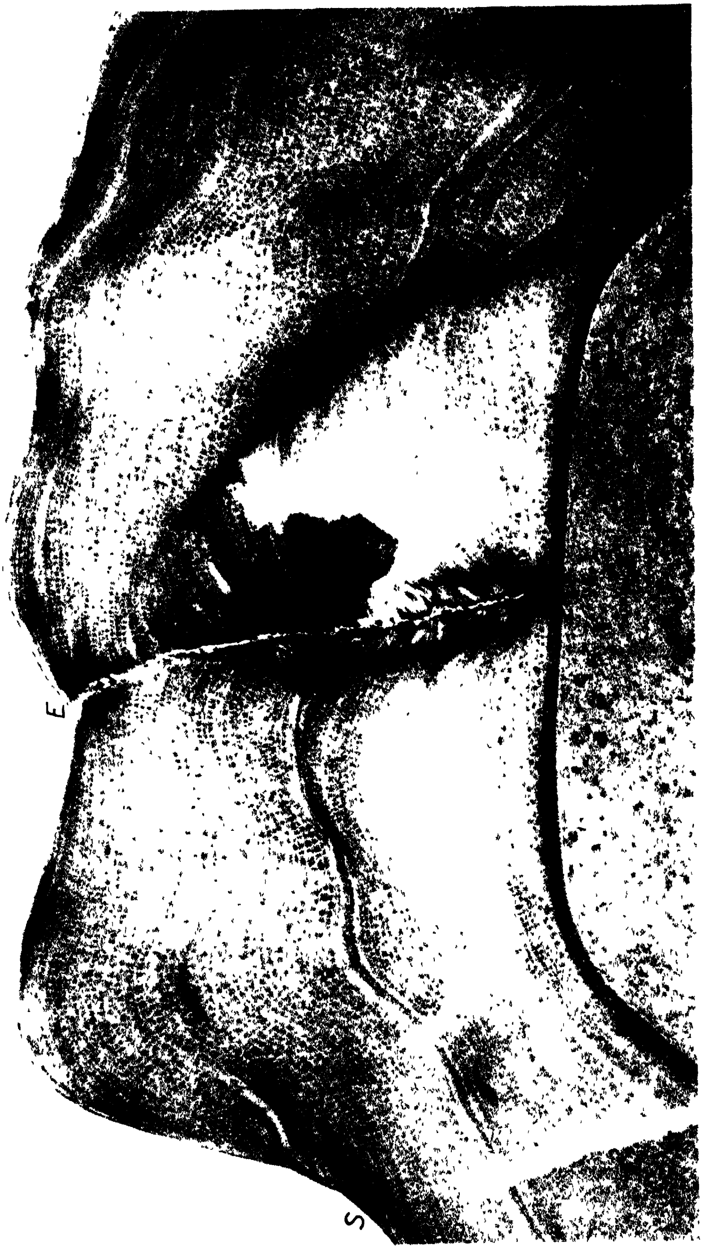
1



2

TAMPSIA BISHOPI STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 16.



TAMPSIA BISHOPI STEPHENSON.

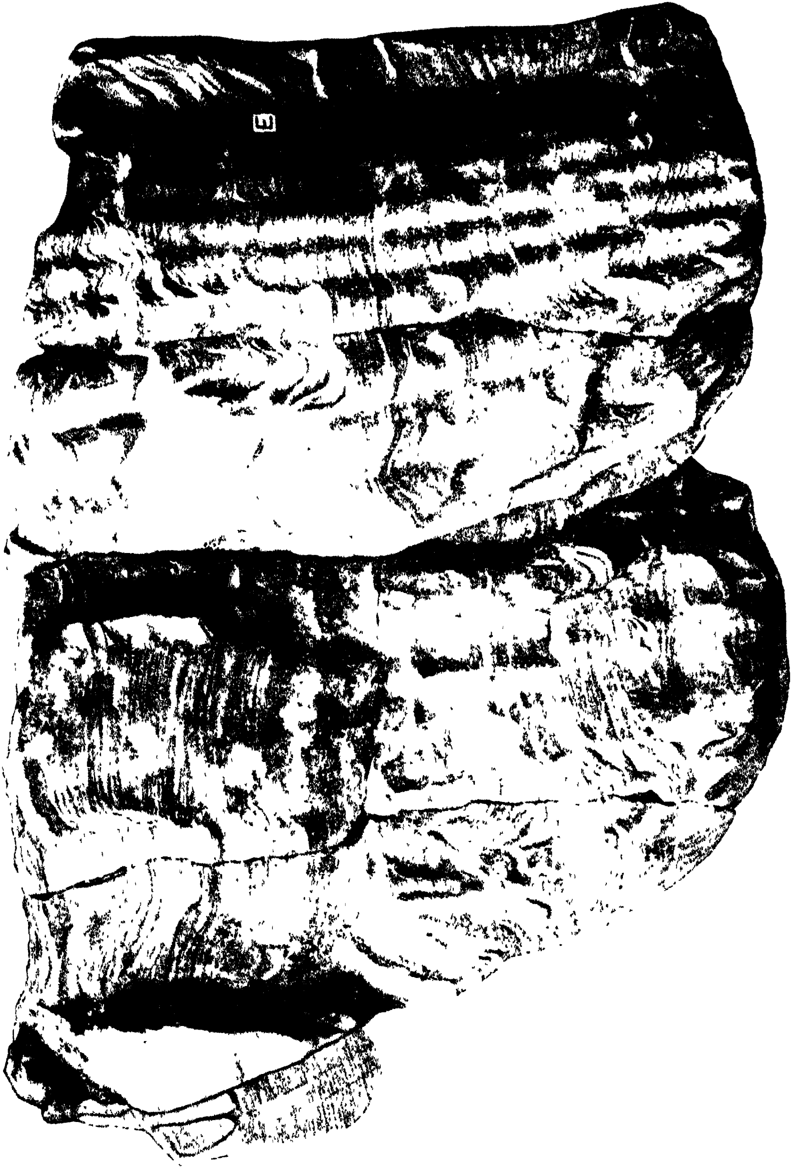
FOR EXPLANATION OF PLATE SEE PAGE 17

PLATE 4.

Tampsia bishopi Stephenson. A portion of the cross section shown in plate 3, figure 2, magnified three times to show the shell structure in the region of the anterior siphonal channel. Page 6.

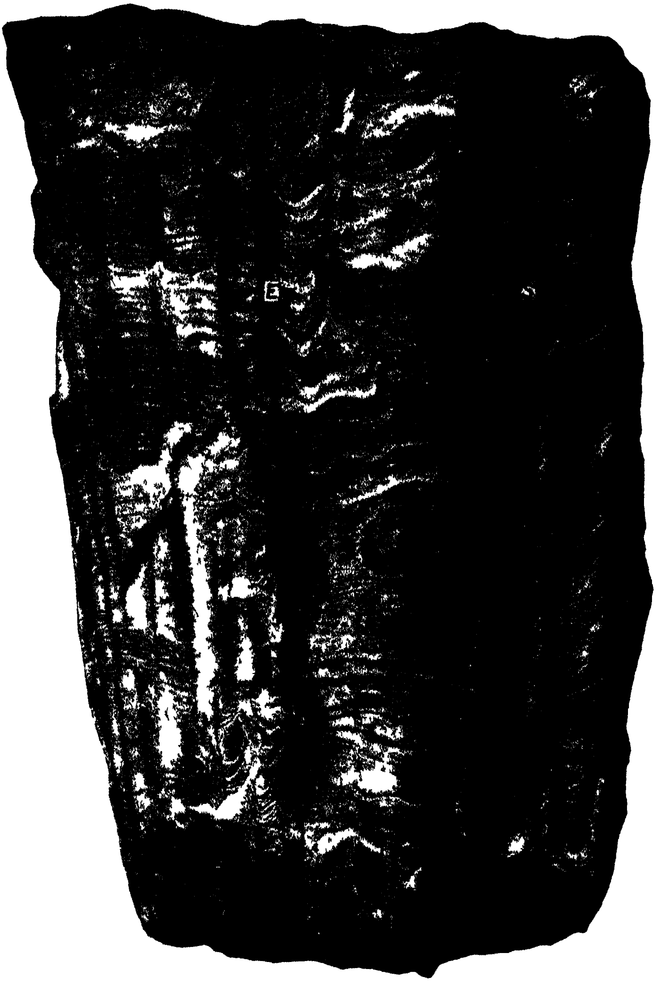
PLATE 5.

Tampsia chocoyensis **Stephenson. Side view of the type pair of individuals about three-fifths natural size, from the upper part of the Mendez** shale on Chocoy hacienda, 1½ kilometers northwest of Omaha station, State of Tamaulipas, Mexico. (E), anterior siphonal channel. The part of the surface shown on the left-hand specimen is nearly the same as that shown on the right-hand specimen, indicating considerable individual variation in the strength of the surface features Cat. No 32500. U.S N M. page 8.



TAMPSIA CHOCOYENSIS STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 18



TAMPSIA CHOCOYENSIS STEPHENSON.

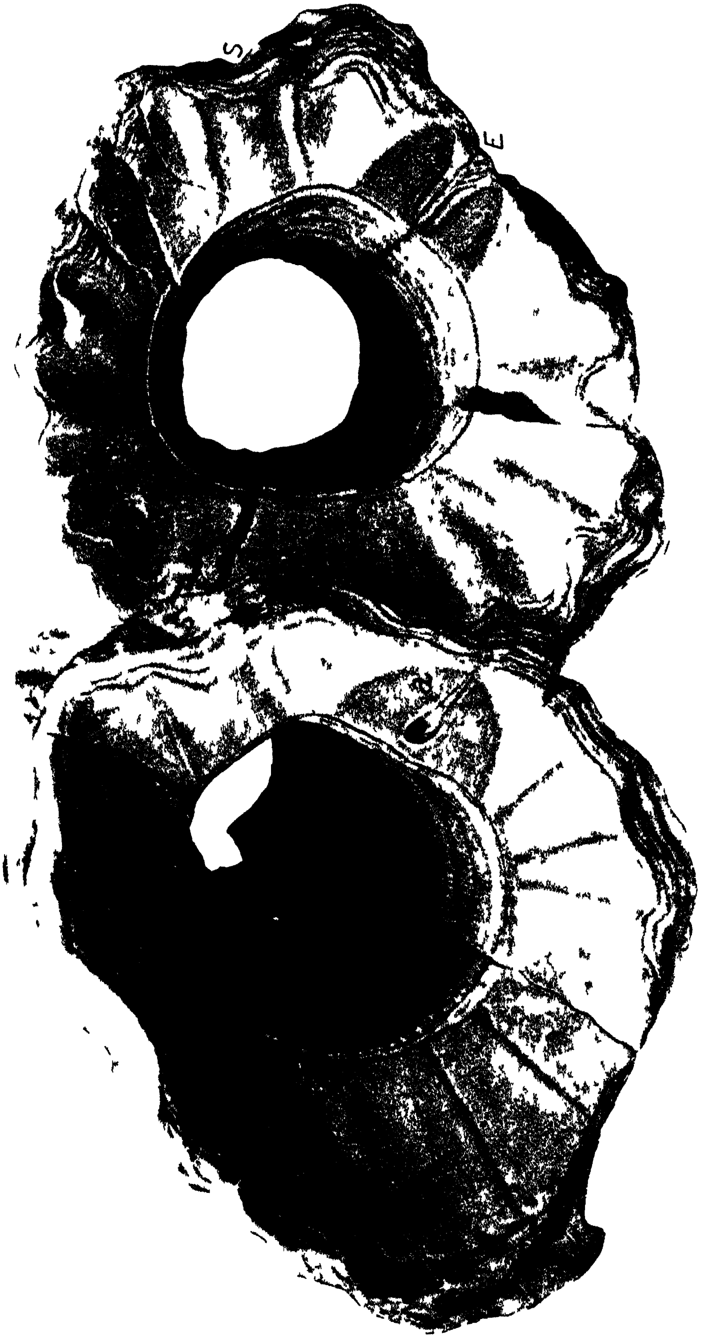
FOR EXPLANATION OF PLATE SEE PAGE 19

PLATE 6.

Tampsia chocoyensis Stephenson. View of the siphonal channels of the right-hand individual shown in plate 5, about three-quarters natural size. (E), anterior siphonal channel, and the slit or sinus *a* at the bottom of the channel. (S), the broad posterior siphonal channel and the narrow, deep, subordinate channel along its center Page 8.

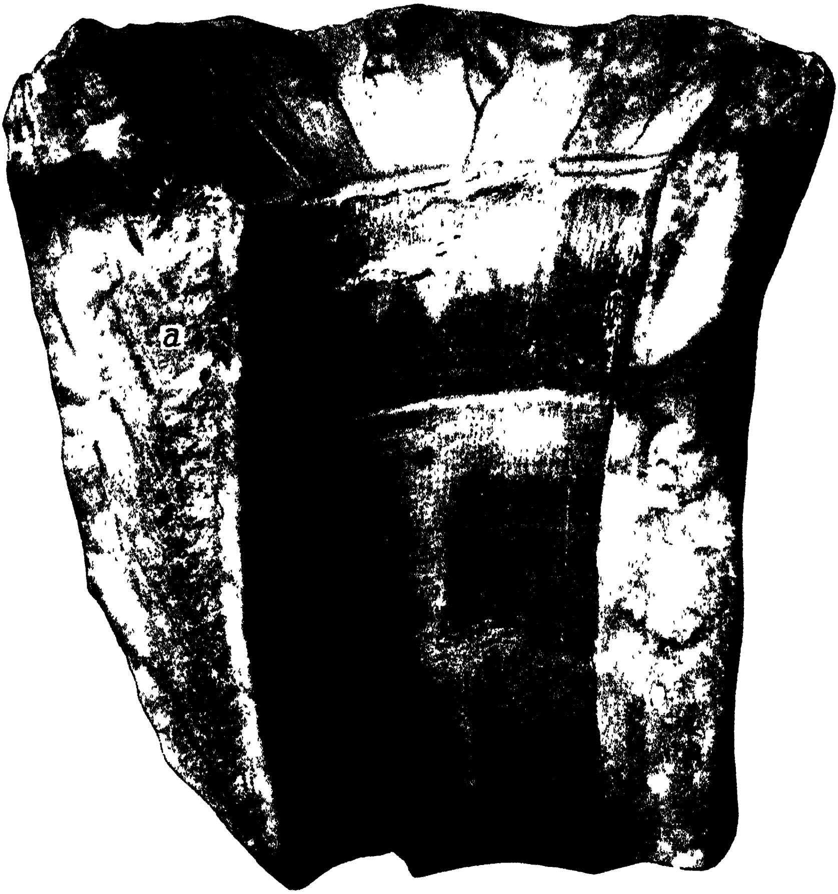
PLATE 7.

Tampsia chocoyensis Stephenson. Top view of the type pair of individuals, about four-fifths natural size, showing the slit or sinus cutting the shell at the bottom of the anterior siphonal area, the depressions in the rim in the region of the siphonal channels, and the radial vessels. Page 8.



TAMPSIA CHOCOYENSIS STEPHENSON

P A A N A E E AG



TAMPSIA CHOCOYENSIS STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 21

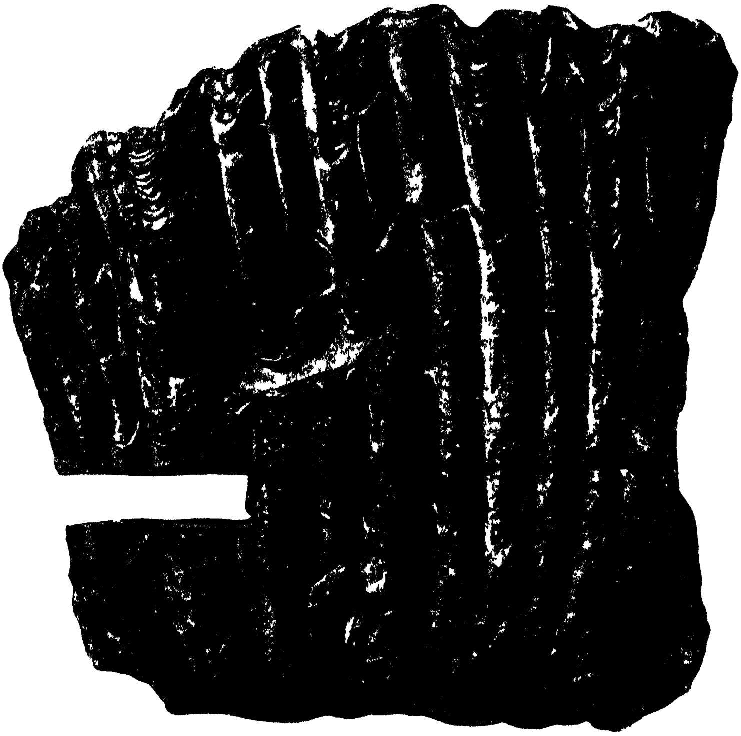
PLATE 8.

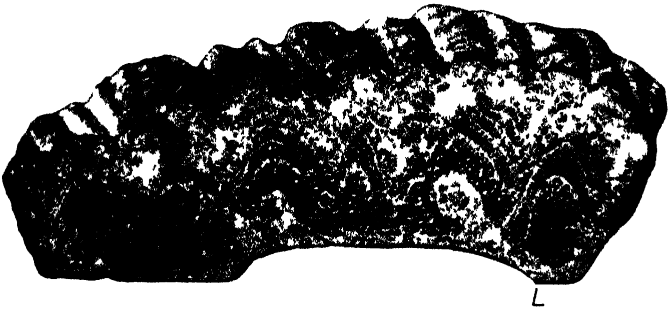
Tampsia chocoyensis Stephenson. Internal view of one of the loose individuals of the colony, natural size, showing especially the edge of the shell on the left, broken along the line of weakness caused by the sinus or slit (*a*) at the bottom of the anterior siphonal channel. Cat. No. 32501, U.S.N.M. Page 8.

PLATE 9.

FIG. 1. *Sauvagesia degolyeri* Stanton(?). Exterior view, natural size, of a fragment from the upper part of the San Felipe formation, Las Flores hacienda, from an arroyo 3½ kilometers west by north of Manuel station. The surface shown is on a part of the shell back of the posterior siphonal area. Cat. No. 32502, U.S.N.M. Page 9.

FIG. 2. Cross section of the fragment shown in figure 1, showing the shell structure. Page 9.

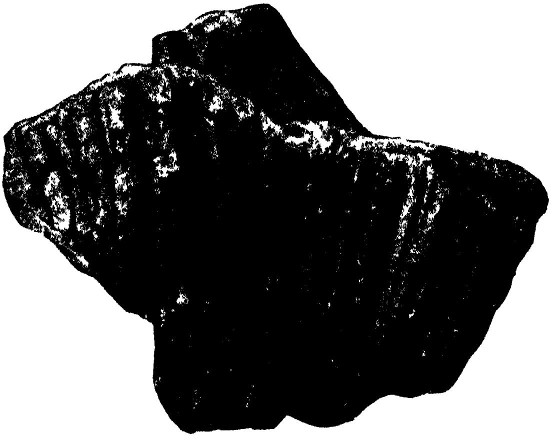




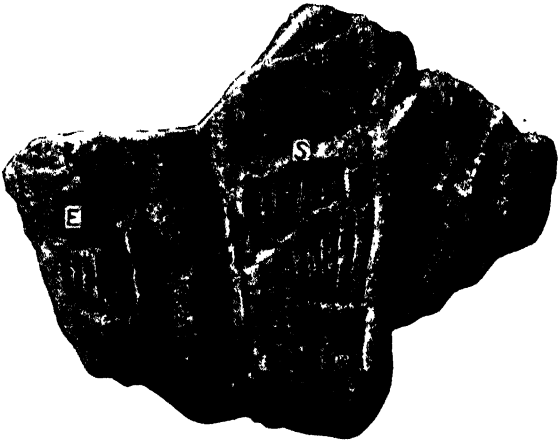
2

SAUVAGESIA DEGOLYERI STANTON?

FOR EXPLANATION OF PLATE SEE PAGE 22



1



2

SAUVAGESIA DEGOLYERI STANTON?

FOR EXPLANATION OF PLATE SEE PAGE 23

PLATE 10.

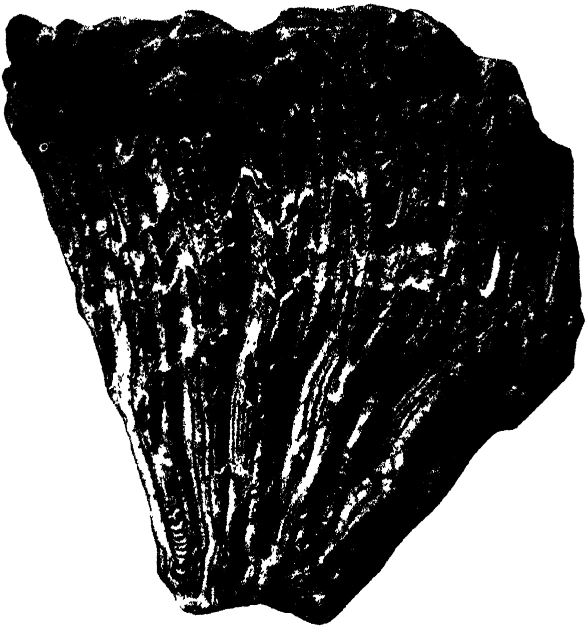
FIG. 1. ***Sauvagesia degloyeri*** **Stanton(?).** View, natural size, of surface sculpture opposite the siphonal areas, of a specimen from the upper part of the San Felipe formation, Las Flores hacienda, from an arroyo 6 kilometers west by south of Manual station. Cat. No. 32503, U.S.N.M. Page 9.

FIG. 2. View of the specimen shown in figure 1, on the side bearing the siphonal areas (E) and (S). Page 9.

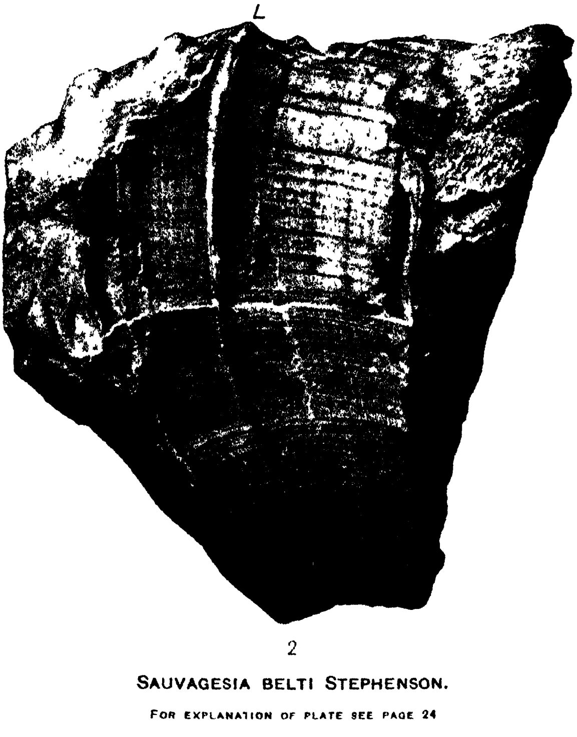
Plate 11.

Fig. 1. *Sauvagesia belti* Stephenson. Exterior view, natural size, of the type, a fragment from the lower part of the Mendez shale, Chocoy hacienda, from gullies west of the track of the National Railways of Mexico, 1⅞ kilometers northwest of Chocoy station, State of Tamaulipas, Mexico. The part of the surface shown is back of the posterior siponal area. Cat. No. 32504, U.S.N.M. Page 10.

Fig. 2. Interior view of the specimen shown in figure 1, showing especially the imperfectly preserved ligamental ridge (L). Page 10.



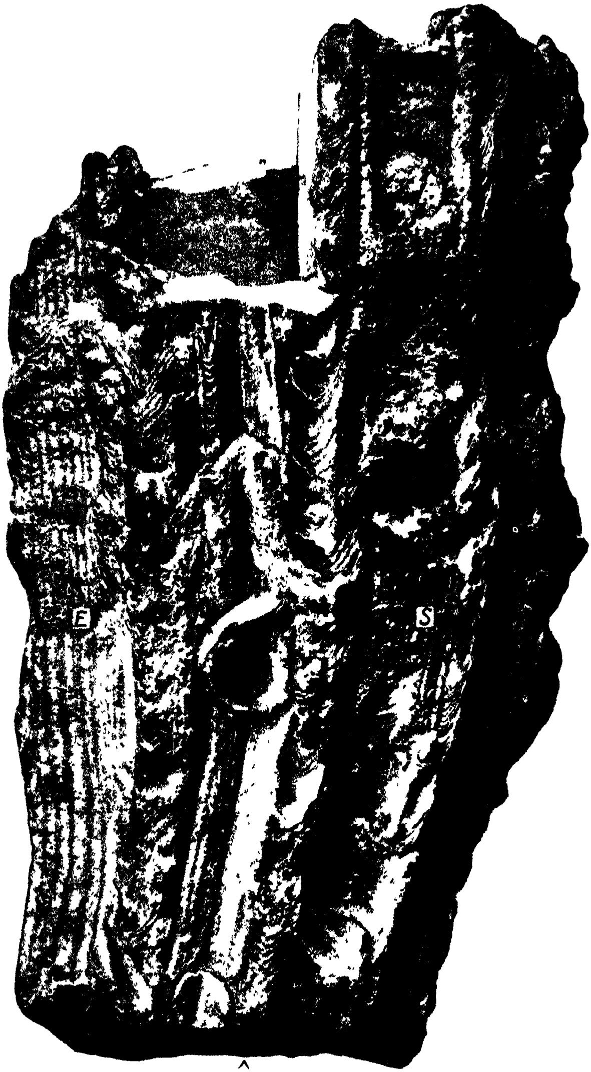
1



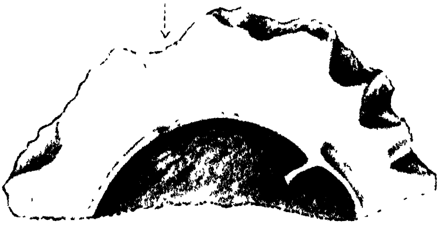
2

SAUVAGESIA BELTI STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 24



1



2

SAUVAGESIA COLORADENSIS STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 25

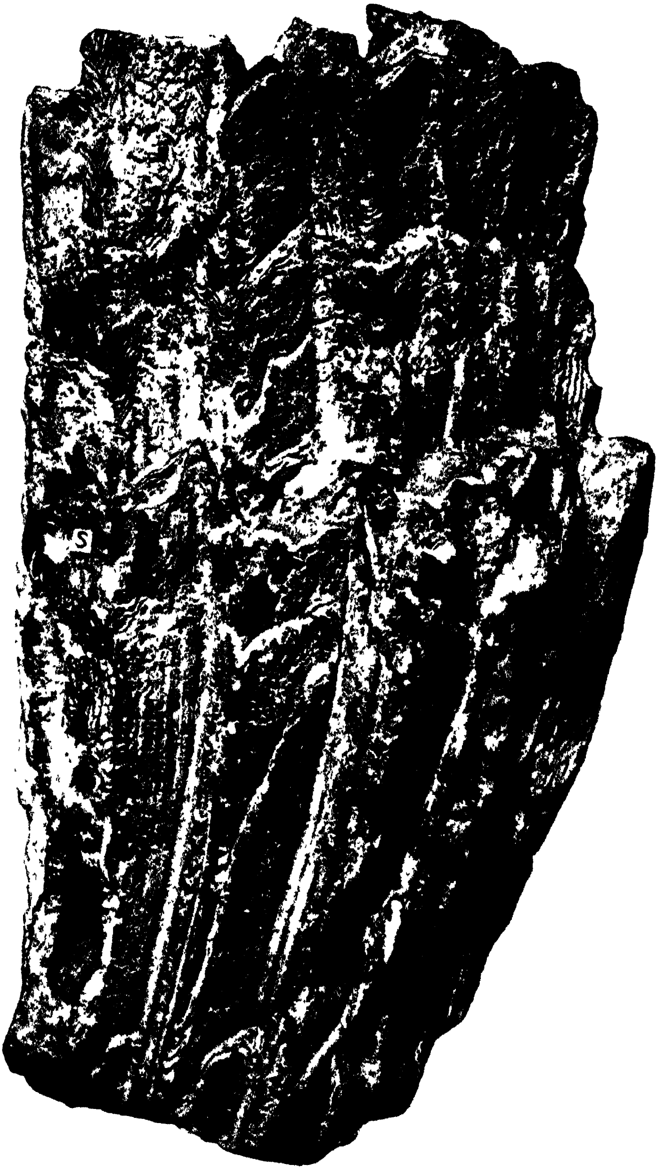
PLATE 12.

FIG. 1. *Sauvagesia coloradensis* Stephenson. View, natural size, of the type specimen on the side bearing the siphonal areas (E) and (S), from the upper part of the Mendez shale, Chocoy hacienda, from gullies 1½ kilometers northwest of Omaha station The surface has been roughened and considerably damaged by corrosion, and a small unidentified oyster is attached to the shell. Cat. No. 32505, U.S.N.M Page 11.

FIG. 2. Diagram of a portion of the lower broken edge of the type specimen of *S. coloradensis*, showing the ligamental ridge (L) in cross section. Page 11.

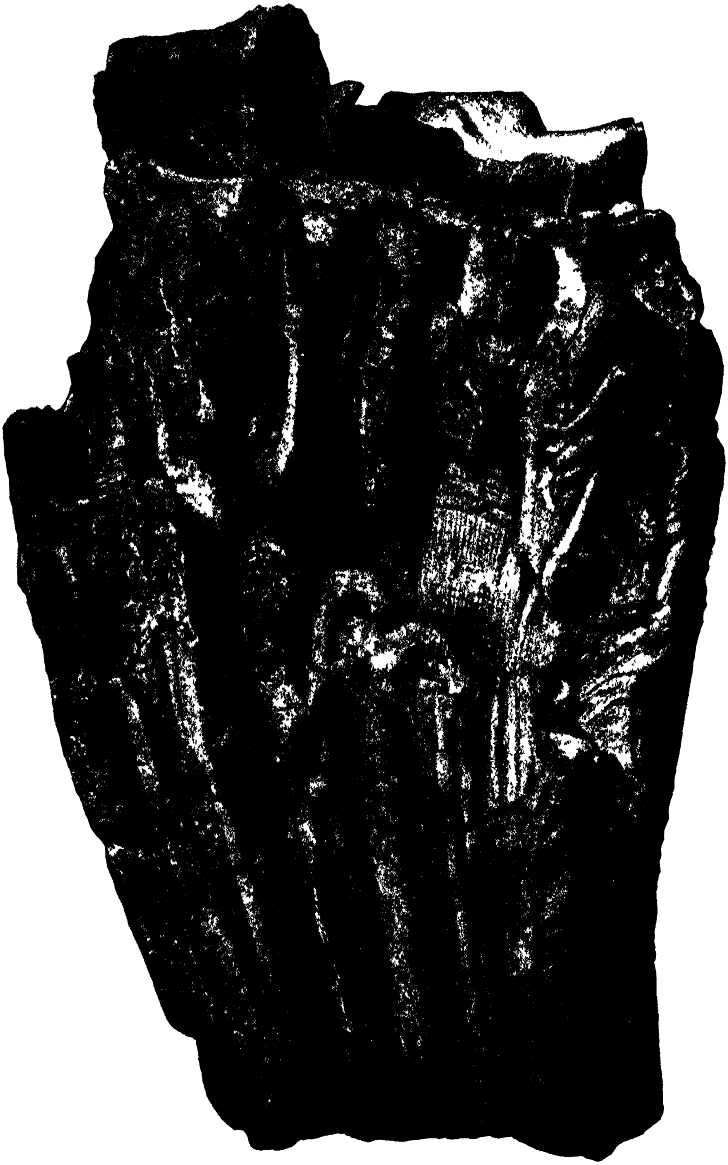
PLATE 13.

Sauvagesia coloradensis Stephenson. View of the type specimen, natural size, showing the posterior siphonal area (S), and the character of the surface sculpture back of that area. Page 11.



SAUVAGESIA COLORADENSIS STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 26



SAUVAGESIA COLORADENSIS STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 27.

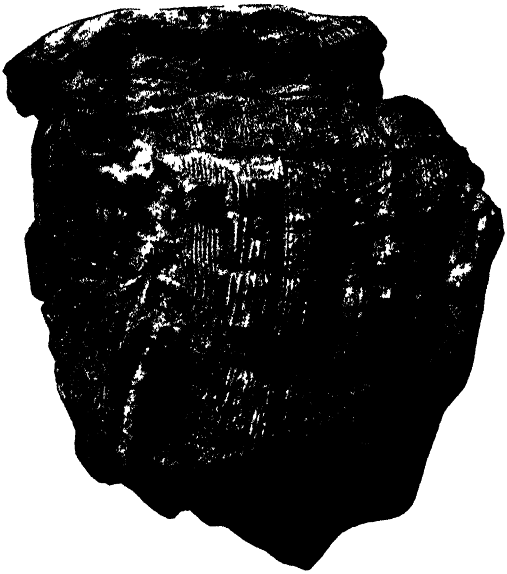
PLATE 14.

Sauvagesia coloradensis Stephenson. View of the type specimen, natural size, showing the character of the surface sculpture in front of the anterior siphonal area. This side of the shell has been mechanically crushed and flattened. Page 11.

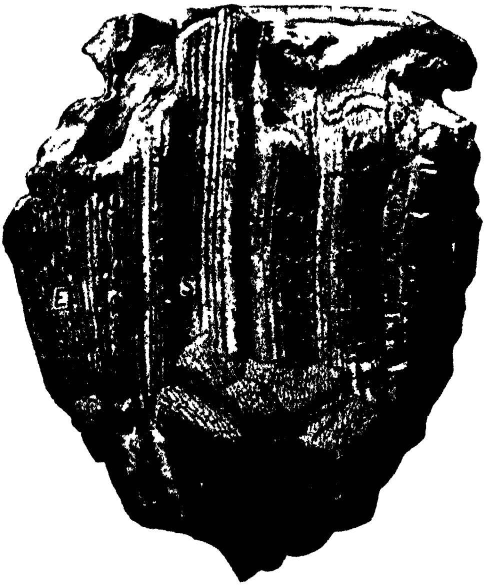
PLATE 15.

FIG. 1. *Durania manuelensis* Stephenson. View of the type specimen, natural size, from the upper part of the San Felipe formation, Las Flores hacienda, from an arroyo 3½ kilometers west by north of Manuel station, showing the surface sculpture on the half of the shell in front of the anterior siphonal area. Cat. No. 32506, U.S.N.M. Page 12.

FIG. 2. View of the type specimen of *D. manuelensis*, showing the siphonal areas (E) and (S) and the surface sculpture back of these areas. Page 12.



1



2

DURANIA MANUELENSIS STEPHENSON.

FOR EXPLANATION OF PLATE SEE PAGE 28.

A REVISION OF THE CHALCID-FLIES OF THE ENCYRTID GENUS CHRYSOPLATYCERUS.

By P. H. TIMBERLAKE.

Of the Hawaiian Sugar Planters' Association, Honolulu.

Chrysoplatycerus Ashmead, 1889 (first described as *Rileya* Howard, 1888, not Ashmead) appears to be an exclusively American genus which probably originated within the tropics and has spread northward through Mexico into California. Up to the present time only two species have been known, the original species *C. splendens* (Howard) from Southern California and *C. howardii* Ashmead described rather indefinitely and uncertainly from Mexico. Recently Mr. G. F. Ferris of Stanford University sent me specimens of a third species which he had collected in the vicinity of San Diego, California. His specimens were reared from a new species of mealybug which Mr. Ferris will describe under the name of *Pseudococcus adenostomae*. Under date of Jan. 2, 1921, Mr. Ferris writes that he wishes credit to be given to Mr. C. R. Gorton, County Commissioner of San Diego County, for the discovery of the material, especially as Mr. Gorton wanted to find out about the parasites.

In the working up of the material I am indebted to Mr. A. B. Gahan for comparing the female with the type of *howardii*, and desire to express my appreciation of this essential service.

The male of *Chrysoplatycerus* has never been described, although Ashmead included the genus in his generic table of the males, the characters given there being wholly suppositional and based on those of the female.[1] This practice pursued by Ashmead in case of several other genera such as *Anicetus*, *Eusemion*, *Coccophoctonus*, and *Zarhopalus* is quite misleading, as the males in these as well as many other Encyrtid genera show a strong sexual dimorphism.

Chrysoplatycerus was placed also in the wrong tribe by Ashmead, as it is unmistakably an Ectromatine and not a Mirine genus. The same may be said for *Zarhopalus*, *Blepyrus* (= *Coccophoctonus* Ashmead), *Chalcaspis*, and *Aenasius*, all of which except *Blepyrus* show close relationship to *Chrysoplatycerus* and *Taftia* in the long curved stigmal vein, while *Blepyrus* is closely allied through *Chalcaspis* by the general habitus. All of these genera except *Blepyrus*, *Chalcaspis*, and *Aenasius* have a deep semicircular scrobal impression, and there is a slight indication of the same structure in *Aenasius*. It is interesting to note that all of these genera except *Taftia* and *Blepyrus* probably originated in America, but other allied genera must occur elsewhere, and I have, in fact, seen a representative of a new genus from South Africa similar to *Chrysoplatycerus* except in lacking the fascicle of hairs at the apex of the scutellum.

---

[1] Proc. U. S. Nat. Mus., vol. 22, p. 347, 1900, and Mem. Carnegie Mus., vol. 1, No. 4, p. 310, 1904.

Genus CHRYSOPLATYCERUS Ashmead.

Rileya HOWARD (J. B. Smith's abstract), Entom. Amer., vol. 4, p. 80, July, 1888, not *Rileya* Ashmead, 1888, which has a few days priority).
Chrysoplatycerus ASHMEAD, Canad. Entom., vol 21, p. 37, 1889.

The female generic characters are well known, but the male, which has but few characters in common with the female, needs to be described.

Generic characters of male.—Head rather thin fronto-occipitally, the face abruptly inflexed; the dorsal surface strongly rounded from side to side, and more or less inclined obliquely forward; frontovertex broad, as wide as long or wider, the ocelli arranged nearly in a right-angled triangle, the posterior pair almost touching both the eye and occipital margins; eyes moderately large, very finely pubescent, strongly convex and rounded in outline, with the posterior margin strongly flattened off; in frontal view the head is well rounded above but somewhat triangular below the eyes, as the cheeks converge strongly toward the narrow mouth, or sometimes after shrinkage the head appears almost circular in outline; face distinctly wider than long, the angulation between it and the frons not carinated as in the female but similar in shape, forming a semicircle and running outward to the lateral margin of the head, not distinctly below or anterior to the eyes as in the female but touching their anterior margins; face below the angulation not so deeply impressed as in the female to form the scrobes: prominence between the antennae convex, its upper margin triangular; cheeks as long as the greatest diameter of the eyes.

Antennae inserted moderately far apart, a little above the oral margin, their sockets being situated a little closer together than the distance from either to the nearest point of the eyes, and nearly twice as far apart as the distance from either to the nearest point of the oral margin; scape short, cylindrical, reaching only to the angulation between the face and frons, together with the radicle joint about as long as the pedicel and first two funicle joints combined; pedicel short, somewhat wider than long and as thick as the scape; flagellum much thicker than the pedicel or scape, slightly tapering toward the apex, compressed so that the funicle joints are narrowly oval in cross section; funicle six-jointed, each joint in broadside view about one-half wider than long and each deeply cupped at both ends with a long stout connecting stalk as seen in transparent slide mounts; club solid, narrowly oval, truncate at base and pointed at apex, as long as the fifth plus sixth and one-half of the fourth funicle joints combined and slightly narrower than the preceding joint; scape and pedicel with coarsely reticulate surface and provided with a few very short inconspicuous bristly hairs; flagellum clothed with similar somewhat finer hairs at the base, but these gradually decrease in size and prominence towards the apex where they are visible only under high magnification; flagellum also provided with very numerous linear projecting sensoria, producing a fringe of short spiny points around the tips of the joints and imparting a peculiar rough appearance to the surface of the joints.

Mandibles about as in the female, small, slender, bidentate at apex with the inner or upper tooth much longer than the other. Maxillary palpi four-jointed, the third joint shortest, the fourth somewhat longer than the preceding joints combined; labial palpi short and two-jointed.

Thorax robust and strongly convex above from side to side; the pronotum short and strongly arcuate; mesoscutum about twice as wide as long or a little less; axillae short, transverse meeting medially and either almost perfectly depressed or somewhat elevated with a slight indication of a transverse median carina; scutellum more or less distinctly shorter than the mesoscutum, convex, well elevated and strongly declivous at the sides, the apex well rounded and without a fascicle of hairs; propodeum very short and transverse. Abdomen small, strongly depressed, triangular in shape with the corners rounded off, and a little longer than half the thorax; vibrissal plates situated on the lateral margins a little before the middle, the vibrissae inconspicuous but reaching nearly to the apex.

Legs moderately long and slender, showing no marked peculiarities, the middle tarsi only slightly thicker than the hind pair. Wings shorter and proportionally wider than in the female, entirely hyaline, the discal and marginal ciliation about normal for the family; marginal vein about two or three times as long as thick, the stigmal very much shorter than in the female, straight, forming an acute angle with the postmarginal and reaching to the middle of the wing-length; postmarginal indistinct distad but at least a little longer than the stigmal.

Face smooth and polished especially in the scrobes, cheeks finely reticulate, frontovertex finely rugosely wrinkled and with numerous minute shallow punctures; mesonotum finely reticulate and somewhat shiny, becoming smoother and brighter towards the sides especially of the scutellum; pleura and abdomen smooth and shining, with delicately impressed reticulations on the basal tergite. Pubescence throughout inconspicuous, but fine short hairs are present around the oral margin and on the frontovertex; the eyes have very fine short erect hairs; the pubescence of the mesonotum and scutellum is rather abundant and seriately arranged, becoming gradually a little longer towards the apex of the scutellum, where there is a pair of much longer suberect bristle-like hairs directed forward; abdomen nearly bare, although a few short hairs are present besides the vibrissae and mainly located on the sides towards the apex.

Coloration black and slightly metallic on the mesonotum and much more strongly metallic bluish or green on the smoother and more polished parts of the body.

KEY TO THE SPECIES CHRYSOPLATYCERUS.

1. Males -- 4
   Females -- 2

2. Frontovertex narrow, the part included between the eyes somewhat over three times as long as wide; scape about twice as long as wide; smooth polished area on each side of the mesoscutum nearly as wide as the shagreened median part; axillae moderately elevated and with an oblique declivity behind the weakly carinate middle; scutellum strongly depressed above, being perfectly flat and highly polished in front of the fascicle; row of bristles bounding the proximal margin of the speculum of the fore wings comparatively thick, long, and prominent ---------------- 3

   Frontovertex much wider, the part included between the eyes not over 2.5 times as long as its posterior width; scape about a half longer again than wide; smooth polished area on each side of the mesoscutum small and longitudinally furrowed, separated from the shagreened median part by a carina; this median part considerably depressed, about three times as wide as the polished areas and extending laterad as far as the outer ends of the axillae; axillae strongly elevated, somewhat depressed anteriorly, then abruptly angled and carinated with a nearly perpendicular posterior face; scutellum strongly convex from side to side and towards the rounded apex, becoming somewhat tectiform towards the base, the disk being finely shagreened in front of the fascicle of hairs; row of bristles on the proximal border of the speculum comparatively short and less prominent; head and thorax ferruginous, the abdomen black with an aeneous and greenish luster ---------------- **ferrisi**, new species.

3. General coloration somewhat metallic bluish and purple, the frontovertex nearly black; polished parts including face, occiput, sides of mesoscutum and the scutellum brilliant metallic green; narrow collar of the pronotum dull orange ferruginous; pleura somewhat ferruginous beneath a strong metallic purple luster; abdomen and dorsal surface of scape and pedicel strongly purple; legs except the ferruginous tarsi mostly blackish, with a greenish luster on the upper surface of the middle and hind tibiae, the middle femora somewhat ferruginous ---------------- **splendens** (Howard).

Head and thorax ferruginous, the abdomen bluish black with an aeneous luster; antennae brownish black without a metallic luster on the scape; legs brown with the tibiae fuscous and the tarsi mostly whitish____howardii Ashmead.

4. Frontovertex a little wider than long, finely rugosely wrinkled and with scattered shallow pin-punctures; mesoscutum and scutellum strongly convex, the axillae somewhat elevated with a declivous posterior face; general coloration black, somewhat shiny but hardly metallic; face, axillae, and metapleura more or less distinctly metallic green, the mesopleura and abdomen more bluish; antennae and legs black with a slight bluish luster on the hind femora, the spur of middle tibiae and the tarsi except apical joint brownish yellow______________________________**ferrisi**, new species.

Frontovertex no wider than long, more finely wrinkled and with fewer, shallower pin-punctures; mesoscutum and scutellum slightly depressed medially, especially in the longitudinal axis, the axillae not at all prominent or scarcely elevated above the scutellum; general coloration black with a slight bluish and aeneous luster, the face, cheeks, pleura, sides of the scutellum and the abdomen with a strong bluish luster; antennae opoque black; legs usually dull blackish, but the femora in one specimen with a distinct bluish luster, the apex of middle tibiae, the spur, and the middle and hind tarsi except apical joint pale yellowish, the trochanters and front tarsi dusky yellowish______________________________**splendens** (Howard).

1. CHRYSOPLATYCERUS SPLENDENS (Howard).

Rileya splendens HOWARD, Entom. Amer., vol. 4, p. 80, July, 1888; and Canad. Entom., vol. 20, p. 194, Oct., 1888.

My specimens of this species were reared as follows: Two females from *Pseudococcus ryani* (Coquillett) on cypress, Pasadena, California, August 13, 1911, and August 19, 1912 (P. H. Timberlake); two females from a species of *Pseudococcus* on *Ceratonia siliqua*, Coronado, California, September 27 and October 8, 1912 (P. H. Timberlake); one male from *Pseudococcus citri* (Risso) bred experimentally November 24, 1912, from a female captured at Whittier, California (P. H. Timberlake); one female, one male from *Pseudococcus maritimus* (Ehrhorn), Riverside, California, October, 1914 (C. P. Clausen); and one male from a species of *Pseudococcus* on *Ceratonia siliqua*, Pasadena, California, July 29, 1915 (E. J. Branigan).

The original host was an undetermined mealy-bug on passion-flower vines at Los Angeles, California (Albert Koebele), and Essig[2] records this parasite from *Pseudococcus citri* at Santa Paula, California. According to my own observations on the parasites of *citri* in California, *splendens* is infrequently met with and is imperfectly adapted to this host. In the experiment mentioned above the female was supplied with a large colony of *citri* on potatoes and although she was observed to oviposit frequently only a single male was reared.

The original figures given by Howard[3] and those by Essig[2] are characteristic of this interesting parasite and show many of the structural pecularities of the genus.

---

[2] Pomona Journ. Entom., vol. 3, p. 521–522, 1911; also Inj. and Benef. Ins. Calif., Monthly Bulletin, vol. 2, p. 271–272 (Ed. 2, pp. 371–372).

[3] Canad. Entom., vol. 20, p. 193, 1888.

2. CHRYSOPLATYCERUS HOWARDII Ashmead.

Chrysoplatycerus howardii ASHMEAD, Proc. U. S. Nat. Mus., vol. 22, p. 405, 1900.

This species was described from two females which were supposed to have been collected in Mexico. Mr. Gahan examined the types for me in the United States National Museum and reported that in regard to all structural characters they were practically identical with *splendens*. The male of this species remains unknown.

3. CHRYSOPLATYCERUS FERRISI, new species.

Female.—Head proportionately a little larger and wider than in *splendens*, being somewhat wider than the thorax, the dorsal surface well rounded, the anterior area between the eyes and the transverse carina without the strongly developed impression found in *splendens;* frontovertex about two and a half times longer than the width in the ocellar region, distinctly but not greatly widening anteriorly; ocellar angle considerably less acute than in *splendens*, the distance between the posterior ocelli being only slightly less than the length of the other sides of the triangle, the posterior pair almost touching the eyes and removed a little more than their own diameter from the occipital margin; eyes somewhat larger than in *splendens*, less protuberant, becoming a little wider anteriorly, their surface glabrous; face nearly as in *splendens* but the transverse carina more deeply curved, thus forming almost a semicircle, the prominence between the antennae slightly and uniformly convex, as long as wide, not abruptly and obliquely inclined forward anteriorly as in *splendens*, and its upper or posterior margin well rounded.

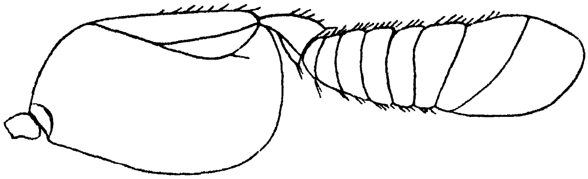


FIG. 1—ANTENNA OF FEMALE CHRYSOPLATYCERUS FERRISI TIMBERLAKE.

Antennae (fig. 1) inserted far apart and not distant from the oral margin; scape laminately expanded and about a half longer again than wide, its base (excluding the radicle joint) slightly obliquely truncate, the apical end rounded, the dorsal part abruptly folded over at more than a right angle with the ventral expansion, thus forming a narrow flattened surface above, widest at the apex and gradually narrowing toward the base, and also forming a groove on the outer surface above to receive the pedicel and part of the flagellum; pedicel in the form of a three-sided pyramid, like that of *splendens* in shape, but proportionately not more than one-half as large, its apex truncate, whereas this part is deeply concave in *splendens;* flagellum comparatively narrow at base and widening perceptibly towards the apex, while in *splendens* it is nearly of the same width throughout; funicle joints all transverse, increasing in length and width distad, being much less cupped and narrowed ventral than in *splendens;* club considerably longer than wide, more rounded and a little longer on the ventral margin than on the dorsal, in length about equal to the last four funicle joints combined and a little wider, while in *splendens* the club equals the funicle in length and width.

Mandibles small, slender, bidentate, the inner or dorsal tooth much longer than the other one; maxillary palpi four-jointed, the first two joints short and about equal, the third still shorter, the fourth rather long and slender or somewhat longer than the preceding joints combined.

Collar of pronotum short and arcuate; mesoscutum with a transverse median part nearly twice wider than long, only slightly convex and abruptly limited from the deeply furrowed sides of the scutum by a sharp carina just even with the outer ends of the axillae; the latter strongly elevated above the scutellum, carinated at the middle, at which point they become abruptly declivous, the posterior surface being perpendicular and meeting the dorsal surface in a right angle; scutellum in the form of a short, bluntly rounded cone, being well elevated and convex at the sides and apex, and convex on the disk although becoming somewhat tectiform at the base, the apical fascicle of hairs rather thicker and slightly shorter than in *splendens;* propodeum large and inclined obliquely backward, moderately long at the middle and about twice as long at the sides, a transverse, broadly arcuate carina present anteriorly and just tangent to the basal margin, a shorter curved carina present on each side running from near the spiracle to the outer end of the transverse carina, the spiracles rather large and almost round; legs and wings (pl. 1, fig. 1) as in *splendens* except in minute details, of which the most important seems to be the much smaller size of the enlarged and flattened hairs guarding the proximal border of the speculum of the forewings.

Abdomen small in dry material, shorter than the thorax by about one-fourth, the dorsum more or less deeply concave, the ventral surface compressed, the ovipositor enclosed and concealed by the ventrites; vibrissal plates situated on each side at or near the middle of the length, the vibrissae reaching nearly to the apex.

Sculpture.—Face, cheeks, and postorbital area of head smoothish and very finely delicately reticulate, the scrobes of the face polished; frontovertex finely malleate-reticulate and with numerous scattered very shallow pin punctures, many of these being in a crowded row at the inner orbits of the eyes; collar of pronotum and disk of mesoscutum very minutely, densely, and roughly granular, the scutum becoming smoother and minutely reticulate on the posterior margin; disk of the axillae and scutellum rather roughly but very finely reticulate; furrowed sides of mesoscutum, the mesopleura, metapleura, and propodeum smooth and polished; declivous parts of axillae smooth but with delicate reticulations, the declivous sides of scutellum similar but more lineolate, especially towards the apex; propleura, prepectal plates, tegulae and abdomen finely reticulate, rougher on the tegulae and coarser on the basal tergite of abdomen; metanotum with several fine oblique carinae on each side.

Vestiture.—Face with very fine whitish pubescence on the prominence between the antennal sockets, the occipital margin of the sides of head with a conspicuous fringe of rather short white hairs; collar of pronotum and disk of mesoscutum rather conspicuously, but not densely, pubescent with short white recumbent hairs; a few similar hairs on the disk of the scutellum, the apical fascicle dense and black; apex of the abdomen with a few black bristly hairs beneath and on the lateral margins, most of these arising from the apical ventrites.

Coloration.—General color of the head and thorax ochraceous orange to tawny (Ridgway) or even darker in one specimen, the frontovertex about Prout's brown or darker, the scutellum still darker and with a dark greenish luster; facial prominence (in some specimens) and the mesopleura with a purple luster; posterior wall of the scrobes and the ventral orbits of the eyes with a pale-green luster; polished sides of the mesoscutum and the metapleura metallic green; declivous part of the axillae brilliant gold, purple-red or greenish in different lights; disk of mesoscutum and axillae with a rather weak, dark bronzy luster; abdomen bluish black, the luster mostly greenish and not especially strong. Scape somewhat tawny in ground color but with a strong metallic green luster which produces a bronzy effect, its ventral margin narrowly blackish; pedicel metallic greenish; the flagellum bluish black, with a distinct but not brilliant metallic luster. Front and middle legs, except the tibiae and middle coxae, as well as the hind coxae concolorous with the pleura or somewhat browner; front and middle tibiae, middle coxae, and most of the hind legs fuscous to blackish, the hind femorra usually browner; dorsal margin of the front tibiae with a bluish luster, the same parts of the middle and hind legs with a greenish luster; apical joint of the tarsi fuscous to blackish, the tarsi otherwise being brownish yellow, although the front pair in one specimen are almost all infuscated and the hind pair have only the second and third joints pale; spur of middle tibiae dark. Wings hyaline on the basal third and then abruptly fuscous on the rest of the disk although becoming slightly paler toward the apex, and with a narrow curved subhyaline line parallel to the posterior margin present as in *splendens;* the veins blackish.

Measurements.—Length of body: (1.51 to) 1.87; length of head: 0.726; width of head: 0.754; width of vertex at posterior ocelli:

0.217; length of scape, exclusive of the radicle joint: 0.485; width of scape: 0.318; length of flagellum: 0.535; total width of mesoscutum: 0.667; width of the disk of mesoscutum: 0.478; length of forewing: 1.46; width of forewing: 0.57 mm.

Male.—Structural characters agreeing with the generic description above and only those distinguishing it from the male of *splendens* need be mentioned here: Head slightly thicker fronto-occipitally, the frontovertex a little wider than long, distinctly more rugose and with more numerous and evident pin-punctures; mesoscutum as finely reticulate as in *splendens*, but slightly more roughly and with the fine seriately arranged hairs more numerous; axillae more elevated and slightly angulated at the middle with an obliquely declivious posterior face; scutellum more convex (being somewhat flattened on the disk in *splendens*), a little more densely and roughly reticulate and with the fine hairs much more numerous; both mesoscutum and scutellum are much less smooth and shining on the sides. Antennae (fig. 2) essentially similar in the grosser characters, although the scape is slightly longer than in *splendens*, but under high magnification the linear sensoria are found to be much more numerous, there being about four transverse rows on each funicle joint and only two or three partial rows in *splendens*. Wings (pl. 1, fig. 2) a little longer and not so broad, especially the hind pair, which are unusually short and wide in *splendens;* the discal ciliation much finer, shorter, and very hyaline in a large quadrate area just beneath the venation beginning at the distal border of the speculum as seen in slide mounts, whereas in *splendens* the whole disk beyond the speculum is uniformly ciliated; discal ciliation of the hind wings is extremely short and hyaline and evident throughout in the case of *splendens;* marginal vein longer and slenderer, nearly three times as long as wide (nearly as wide as long in *splendens*), stigmal vein somewhat shorter, the postmarginal considerably longer and more distinct being about twice as long as the stigmal (only slightly longer than the stigmal in *splendens*).

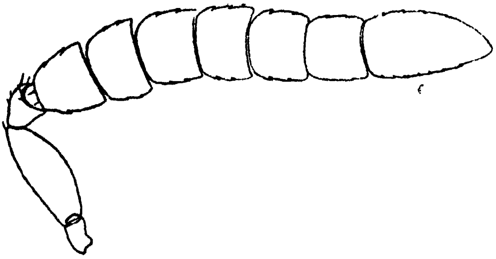


Fig. 2.—Antenna of male Chrysoplatycerus ferrisi Timberlake.

Coloration rather dull and very slightly bluish black, the mesopleura and abdomen much more shiny and bluish, the scrobes, declivous part of the axillae and the metapleura with an evident metallic greenish luster; mouth parts largely yellowish, the antennae dull blackish; legs black with a bluish luster on the hind femora, the knee joint and tip of the tibiae of the front and middle legs, middle tibial spur and all the tarsi except apical joint brownish yellow, although the tarsi of the front and hind legs may be somewhat dusky; wings hyaline, the veins dusky yellowish.

Measurements.—Length of body: (0.84 to) 1.18; length of head: 0.450; width of head: 0.474; width of vertex at posterior ocelli: 0.223; width of mesoscutum: 0.523; length of forewing: 1.07; width of forewing: 0.518 mm.

Described from five females, five males (type, allotype, and paratypes) reared September 10, 1920, from *Pseudococcus adenostomae* Ferris, collected in the vicinity of San Diego, California (G. F. Ferris).

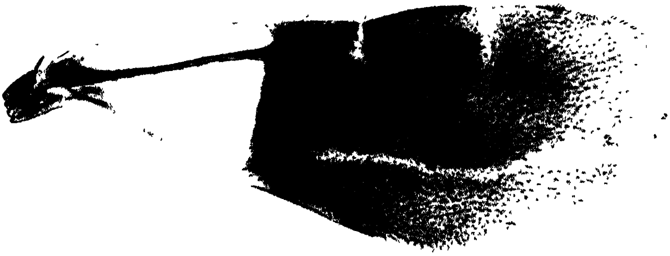
This fine species is named after Mr. Ferris in recognition of his excellent and much needed work on the Coccidae.

Type, allotype, and paratypes.—Cat. No. 25087 U. S. N. M. Paratypes in author's collection.

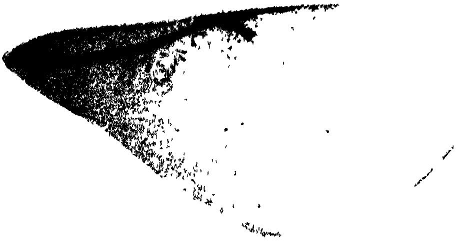
EXPLANATION OF PLATE.

Chrysoplatycerus ferrisi Timberlake.

FIG. 1. Forewing of female.
2. Forewing of male.



1



2

FOREWINGS OF CHRYSOPLATYCERUS FERRISI TIMBERLAKE

FOR DESCRIPTION OF PLATE, SEE PAGE 10

THE SMALLEST KNOWN HORNED DINOSAUR, BRACHYCERATOPS.

By Charles W. Gilmore,

Associate Curator, Division of Paleontology, United States National Museum.

The mounted skeleton of *Brachyceratops montanensis* recently placed on exhibition (pls. 1 and 2) in the United States National Museum is the smallest horned dinosaur that has yet been discovered. It was found by the writer during the summer of 1913 in the Two Medicine formation of the Upper Cretaceous, while working under the auspices of the United States Geological Survey on the Blackfeet Indian Reservation, in northwestern Montana.

Since the osteological details[1] of the skeletal structure have been fully described, it is proposed here to give only a brief account of the specimen as it is now prepared for exhibition.

The mounted skeleton is 1625 mm. (5 feet, four inches) long from the end of the beak to the tip of the tail, and stands about 762 mm. (30 inches) high at the hips, with a skull that measures 558 mm. (22 inches) in length. The skeleton is mounted standing on a base of artificial matrix calculated to represent the color and texture of the layer in which the bones were originally found. The animal is posed in a quadrupedal walking position, the forelimbs strongly flexed at the elbow, as indicated by the strong olecranon process of the ulna. The tail drops rapidly from the sacrum and its distal portion drags upon the ground. The scapula has been given a horizontal position well down on the sides of the ribs, in accordance with the evidence of the position of this bone in an articulated skeleton of *Monoclonius* in the American Museum of Natural History, New York City.

The painstaking care entailed in cleaning the bones of this skeleton from the adhering matrix, fitting together of the broken pieces, the restoring of the missing parts, and the articulation and mounting of the specimen can be more fully appreciated when it is explained that Mr. Norman Boss, who has so skillfully done all of this work, spent 345 working days, or over a year, in its preparation.

---

[1] Gilmore, Charles W., Smiths. Miscell. Coll., vol. 63, No. 3, 1914, pp. 1–10; Prof. Paper 103, U. S. Geol. Survey, 1917, pp. 1–38, pls. 1–4, 47 text figures.

It is a composite skeleton, that is, made up of the bones of more than one individual, but all from the same deposit, a small rectangular area of about 6 by 7 feet (1828 to 2133 mm.) in extent. In this small space were found the bones of at least five individuals, all pertaining to this one species and all practically the same size. With the exception of two articulated hind feet and three series of caudal vertebrae, one of which, Cat. No. 7953, U. S. N. M., was entire and articulated with the sacrum, and it in turn closely associated with the complete pelvis and femora, all of the other skeletal parts were disassociated, and it was quite impossible to determine the precise individual to which they belonged. Specimen No. 7953, U. S. N. M., was used as the basis for the present mount. The ribs and presacral vertebrae have been tentatively associated with this rear portion, though it is quite probable that the association in some instances may be in error.

The skull was found disarticulated, but the sutures interlocked so perfectly as to leave no doubt that the assembled elements belonged to the same cranium. The juvenile character of this particular animal is indicated by the open sutures of the skull, vertebrae, and sacrum. When fully grown it was doubtless a relatively small species.

The presacral vertebral series is represented by parts of some 13 vertebrae, none of which were found in sequence, nor were any of the neural processes attached to their respective centra. These have been arbitrarily associated, and the position in the column was determined as carefully as possible by comparison with the articulated skeleton of *Monoclonius* mentioned above. The vertebral column has been given the same number as found in the *Monoclonius* skeleton, which consists of 14 dorsals and 8 cervicals, or 22 in all, as in *Triceratops*. Parts of 23 ribs, several of which are complete, have been inserted in the restoration, but, as with the vertebrae, the same doubt exists as to their all belonging with specimen No. 7953.

The structure of the forefoot is perhaps somewhat conjectural, although as restored it is based on a complete articulated forefoot of *Monoclonius*, kindly loaned by the authorities of the American Museum of Natural History, New York. The few foot bones found have been inserted in accordance with the evidence of the borrowed foot.

The greatest difficulty encountered in mounting this specimen was in articulating the bones of the pelvic arch. It was found to be impossible to do this properly owing to distortion by crushing of the individual parts. However, this is hardly noticeable except as one makes a critical examination of this portion of the skeleton.

The missing bones have been restored largely, as in the case of the humeri both of which were gone, from the homologous bones of *Monoclonius*. The restored portions have been given a distinctive color which at once distinguishes them from the original parts, as is well shown in the illustrations in plates 1 and 2.

The bones used in this composite mount are catalogued as follows:

Skull and lower jaw	No. 7951
Vertebral centra and processes	No. 7953?
Sacrum and complete caudal series	No. 7953
Complete pelvis	No. 7953
Femora	No. 7953
Ribs	No. 7953?
Scapula, left	No. 7953
Ulna, left	No. 8076
Radius	Nos. 8077, 8078
Bones of left forefoot	No. 8079
Fibula, tibia, and left hind foot	No. 7957

The small size of *Brachyceratops* is strikingly brought out by comparison with the *Triceratops*, as shown in plate 3, where, as may be seen, the length of the entire skeleton is less than that of the skull of the larger animal, but the proportions of the two are remarkably similar. In each the skull is about one-third the length of the entire animal; in the extreme shortness of the body, the deep thoracic cavity, and in other peculiarities they are essentially similar, though representing the two extremes of their race.

A life restoration of *Brachyceratops*, modeled one-sixth natural size and based on the materials forming the composite specimen, is shown in plate 4. The pose is very similar to that adopted for the skeleton. While it will probably be found to be incorrect in some respects, it at least gives some idea of the life appearance of the animal. The attempt is here made for the first time to depict the character of the scaled skin. That the horned dinosaurs had a scaled integumentary covering is now well known from several specimens discovered in the Belly River formation, Upper Cretaceous of western Canada. Some of these specimens had considerable areas of skin impression preserved and though the patterns differ in the several species, those adopted for *Brachyceratops* may be considered tentative until the discovery of actual impressions shall disclose their true nature.

EXPLANATION OF PLATES.

PLATE 1.

Lateral view of the mounted skeleton of *Brachyceratops montanensis* Gilmore in the U. S. National Museum. Viewed from the left side. About $\frac{1}{10}$ natural size. Restored portions indicated by the light-colored areas.

PLATE 2.

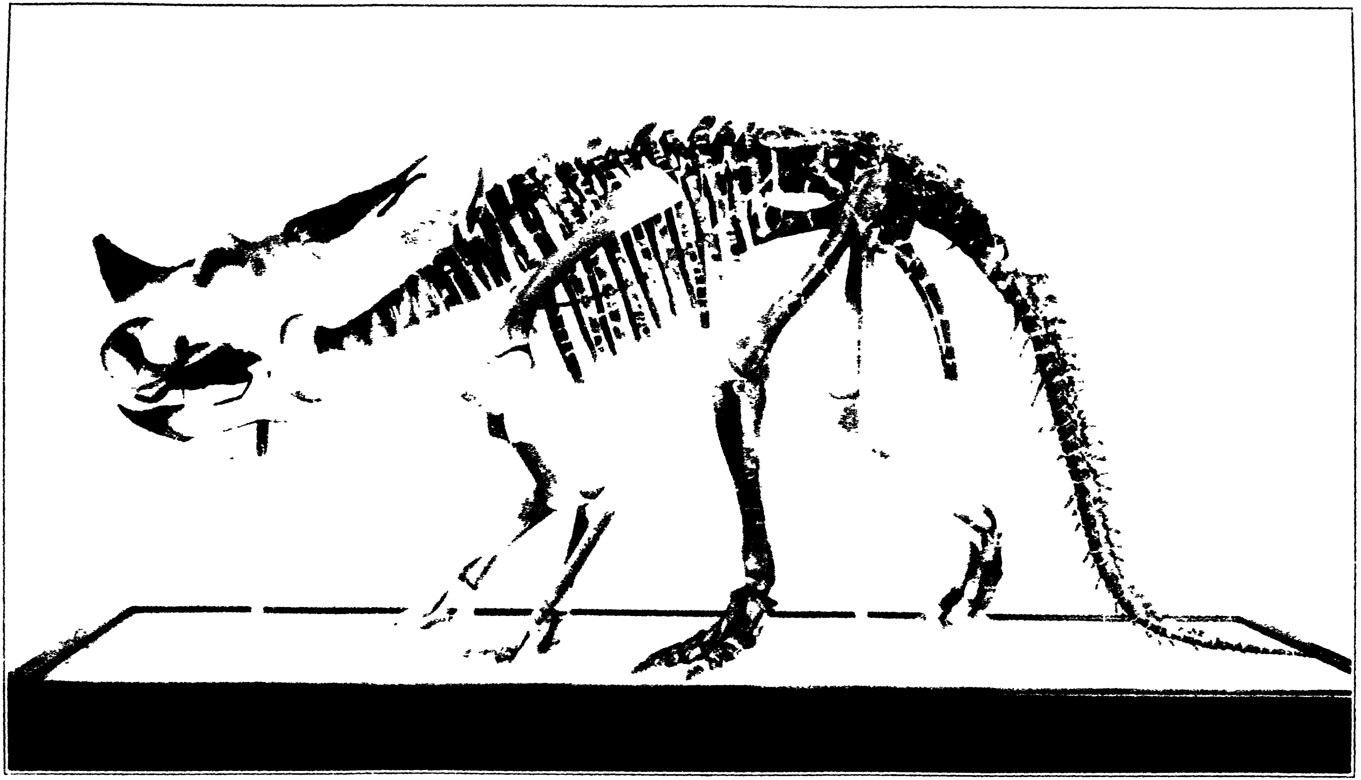
Same skeleton viewed from the right side.

PLATE 3.

Comparative view of the mounted skeletons of *Brachyceratops* and *Triceratops*, both in the United States National Museum.

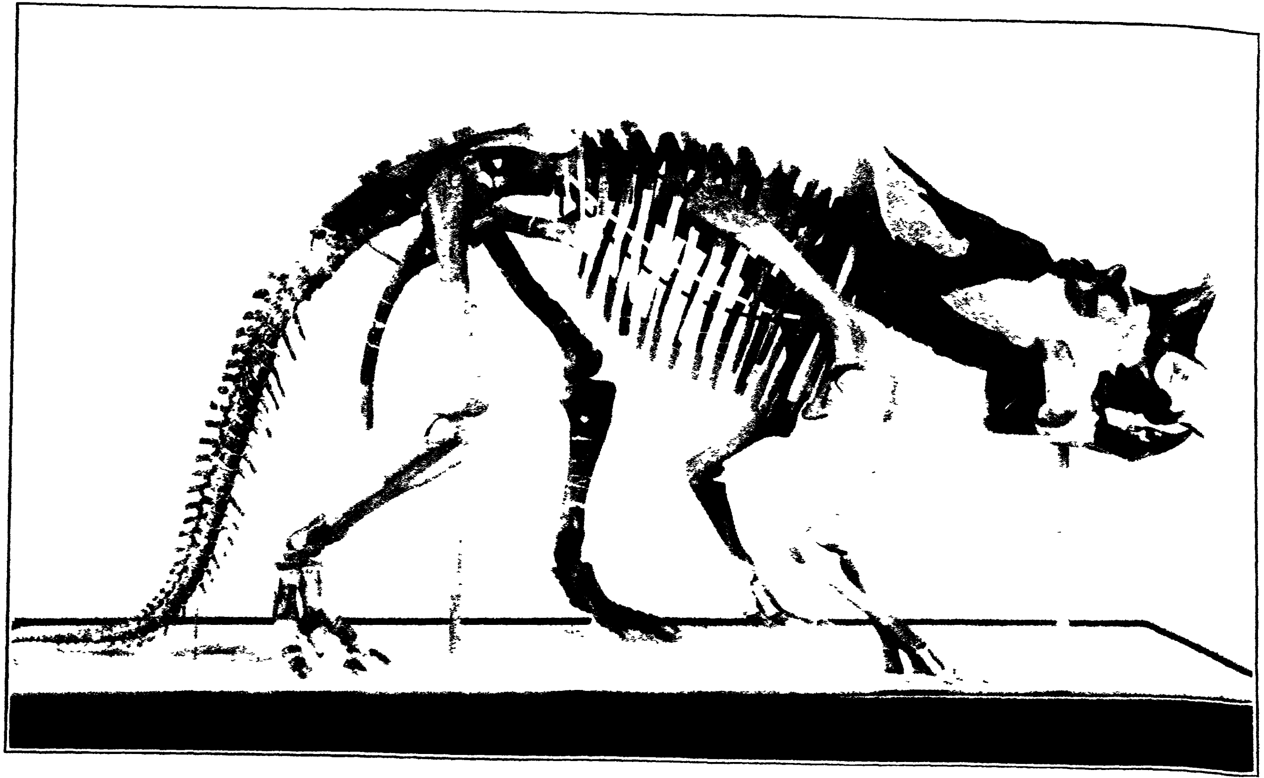
PLATE 4.

Restoration of *Brachyceratops montanensis* Gilmore. Based on the mounted skeleton about natural size. Modeled by Charles W. Gilmore. 1915.



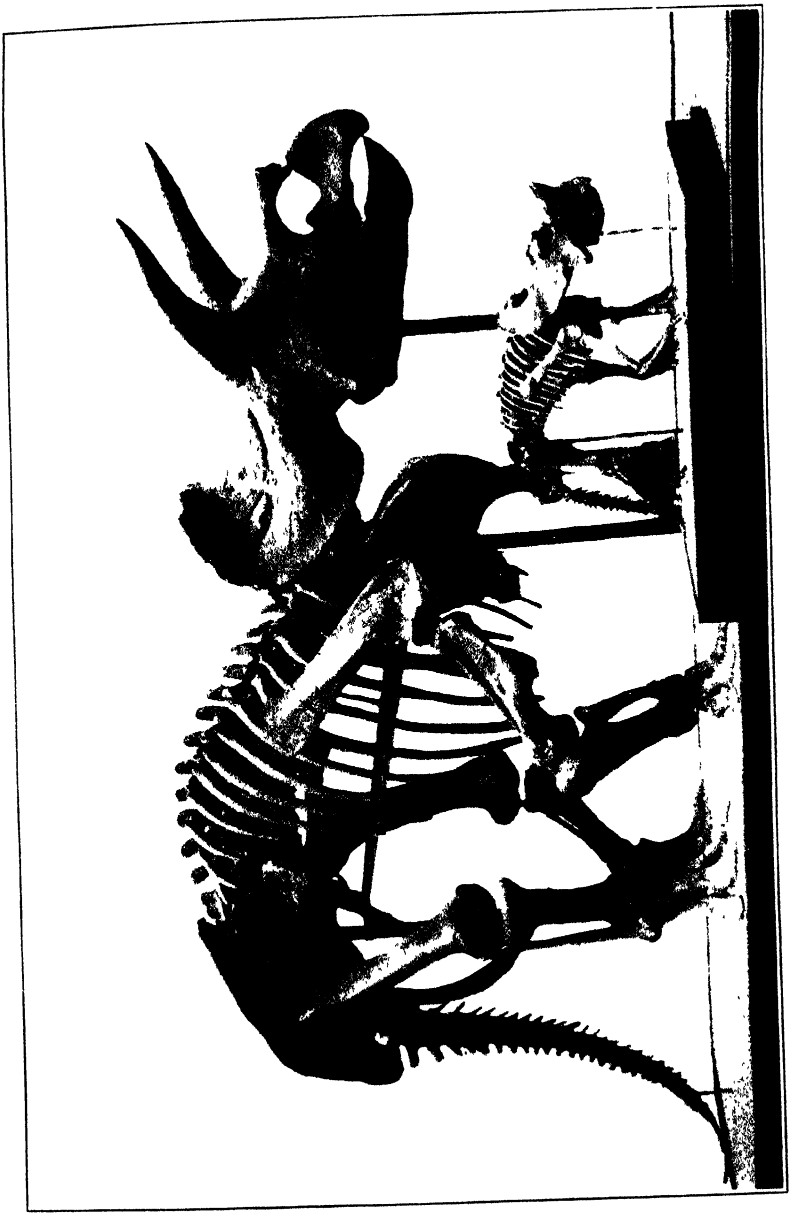
Mounted Skeleton of Brachyceratops montanensis, Viewed from the Left Side.

For explanation of plate see page 3



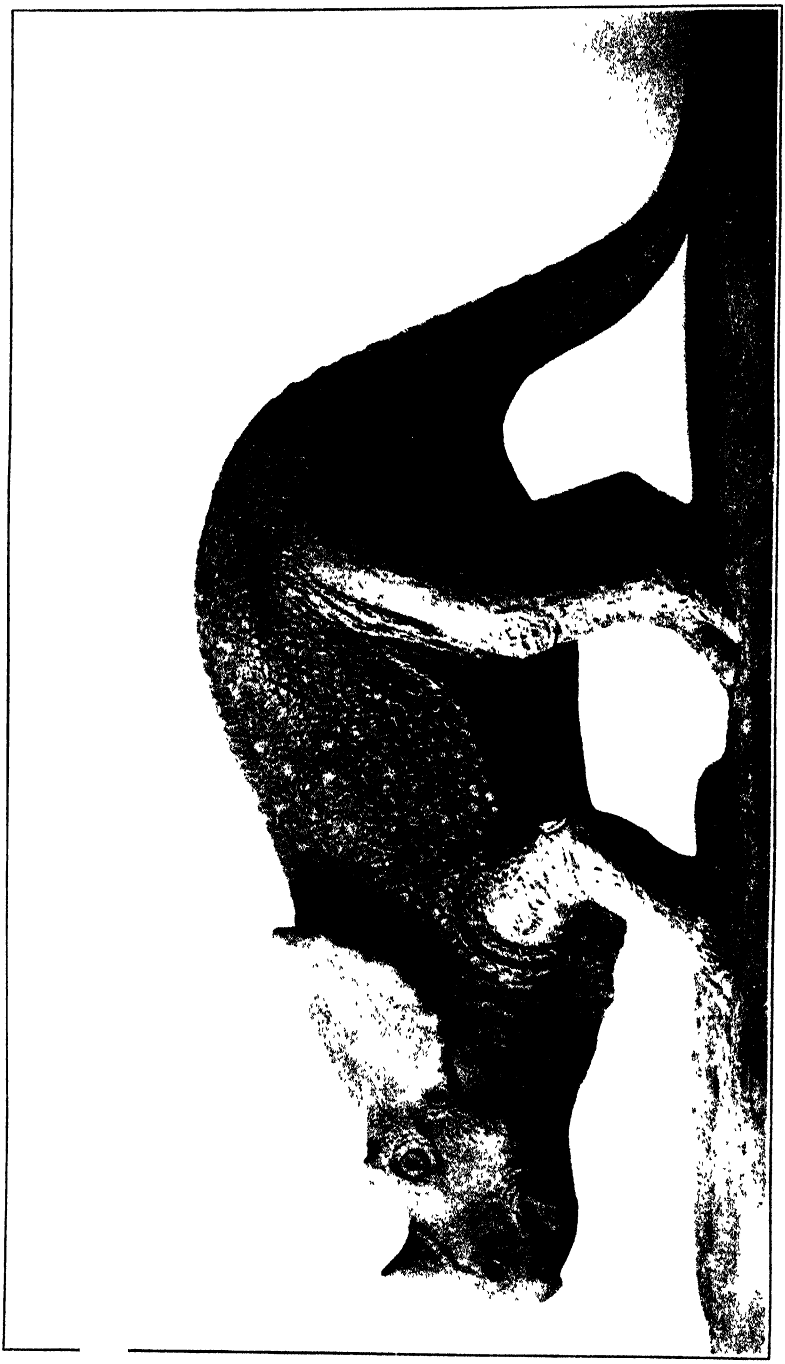
MOUNTED SKELETON OF BRACHYCERATOPS MONTANENSIS, VIEWED FROM THE RIGHT SIDE.

FOR EXPLANATION OF PLATE SEE PAGE 4



MOUNTED SKELETONS OF BRACHYCERATOPS AND TRICERATOPS.

FOR EXPLANATION OF PLATE SEE PAGE 4



RESTORATION OF BRACHYCERATOPS MONTANENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 4

ON METEORIC IRONS FROM ALPINE, BREWSTER COUNTY, TEXAS, AND SIGNAL MOUNTAIN, LOWER CALIFORNIA, AND A PALLASITE FROM COLD BAY, ALASKA.

By George P. Merrill,
Head Curator of Geology, United States National Museum.

ALPINE, BREWSTER COUNTY, TEXAS.
(Cat. No. 513, U.S.N.M.)

The iron described below was received in 1915 from a Mr. E. M. Flynn, of Alpine, Texas, who reported having found it in the Chico Mountains in the southwestern part of Brewster County. Correspondence held with the view of securing the entire mass resulted in failure, and I have not been able to learn of its ultimate disposition. The weight of the original mass was given as about two tons; the fragment received was in form of a solid triangular mass weighing 212 grams. One face showed a broken surface, since polished and etched (see fig. 2, pl. 1), the others the usual slightly oxidized surface. As shown in the illustration, this is a finely and evenly granular iron, the uniformity of texture of which is broken only by three irregularly double, wavy bands of dark spots a half millimeter or so in diameter, which, on a reflected surface seem each to be surrounded by a narrow border or halo of lustrous material. The spots do not, however, differ structurally from the surrounding iron, into which they merge gradually. Their color suggests that they may be due to finely disseminated carbon. They do not oxidize in the process of etching with nitric acid as would be the case if they were troilite. Except for the presence of these spots, the iron resembles the most granular portions of that of Forsyth County, North Carolina. I find no evidences of cleavage or Neuman lines, and except for the spots the mass is apparently homogeneous.

Analysis by Dr. J. E. Whitfield yielded:

	Per cent.
Silicon	0.015
Sulphur	0.012
Phosphorus	0.328
Manganese	none.
Nickel	5.620
Cobalt	0.430
Copper	0.016
Iron	93.600
Carbon	0.008
Total	100.029

It is questionable to just which of the groups in the commonly accepted classification the iron should be referred. Its granular structure would naturally place it with the hexahedrites, but that there is a total lack of evident cubic cleavage or Neuman lines. Its resemblance to the interior portion of the Bingara iron as figured by Brezina is very close, but it lacks the other characteristics of the hexahedrite group. On the other hand, it is practically indistinguishable from the granulated portions of the Forsyth County iron, which is commonly classed as an ataxite. The locality in which the iron is reported to have been found would naturally suggest its possible connection with the Coahuila fall with which it is chemically almost identical (see Cohen, Meteoreisen Studien III, p. 104), but its structural dissimilarity is very evident to one at all conversant with these matters. For the present, and until other portions are available for study, I am inclined to class it as an ataxite of the Saratik group, though the high per cent (0.328) of phosphorus might, in some minds, raise a doubt.

SIGNAL MOUNTAIN, LOWER CALIFORNIA.

(Cat. No. 611, U.S.N.M.)

A small piece of this iron was sent the Museum early in August, 1919, accompanied by a letter from which the following is an abstract:

> Several years ago I was sitting in the shade of some willow trees at the foot of the levee on No. 5 Canal at the point where it crosses the border from Mexico to the United States. It was a hot day, about 3 p. m. and no wind, when suddenly there was a rumble and a "woosh" (no other word seems to fit it) and a series of muffled explosions, which I at first thought was an earthquake. Then the willow trees all bent toward the west, as though there was a strong east wind, though I did not notice any wind.
>
> I ran up on the levee where I could see out. There was a long streak of yellowish-green smoke, that started in the northeast and ended against the side of the Sierra Madras just south of Signal Mountain—in other words the streak started just north of east, over in Arizona, and ended just south of west in Lower California. I realized that the muffled explosions came from the mountain and that the streak of smoke was the trail of a meteor, traveling not very high up, for the east end did not appear to be much higher than the west end. The thing made so much disturbance that it attracted the attention of almost everyone in the vicinity, and a great many prospectors have looked for it since, one of them, a Mexican friend of mine, finally found what I believe is the largest piece of it. It appears to be solid iron, though a Denver, Colorado, assay office gives it a small amount of nickel. The piece is the same general shape and size as the head of a yearling calf, and weighs about 140 pounds. It is so malleable that you can not break the thin edge with a hammer.

The meteoric nature of the iron was easily recognized and steps taken which it was expected would result in the acquisition of the entire mass by the United States National Museum. Unfortunately, through the intervention of a third party, these wishes were not realized, and the description here given rests upon an examination of the fragment first received.

The fragment is beautifully pitted and coated with but a very thin brownish crust, little oxidized, testifying to the supposed recency of its fall. A polished surface shows it to be a medium octahedrite, but of more than ordinary interest from the fact that along one end is a curving border of a maximum thickness of 7 mm. of a distinct, finely granular structure into which the typical octahedrite figures pass gradually (fig. 1, pl. 1). It is plainly a case of natural heat granulation during flight—the metabolite structure of Berwerth—which, so far as I recall, has been exemplified only in the case of the iron of Charlotte, Dickson County, Tennessee. A natural inference is that this portion represents the *brustseite* of the iron during its flight. The small amount of the material at my disposal prevents as complete a chemical examination as might be desired. A 10-gram fragment containing no visible troilite, carbon, or schreibersite segregations yielded Doctor Whitfield:

	Per cent.
Silicon	0.004
Sulphur	0.002
Phosphorus	0.041
Nickel	7.860
Cobalt	0.600
Copper	0.015
Iron	91.470
Total	99.992

These figures present no features not common to octahedrites, or that in themselves alone would serve to distinguish this from numerous others that might be mentioned belonging to the same group.

COLD BAY, ALASKAN PENINSULA.

(Cat. Nos. 633 636, U.S.N.M.)

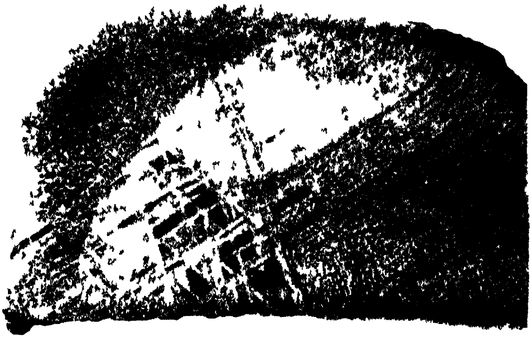
The meteorite (pallasite) described below was brought to the writer's attention by Mr. S. R. Capps, of the United States Geological Survey, who reported:

> This meteorite was found in June, 1921, on a mountain top about three miles west of the trading post at Cold Bay on the Alaskan Peninsula. When found it was perhaps as large as a man's two fists. It was broken into fragments and a large part of it, at least, was lost before I discovered it was a meteorite. It is possible that there are a few fragments in existence. I will try and reach the man who may have them and obtain them for the Museum.

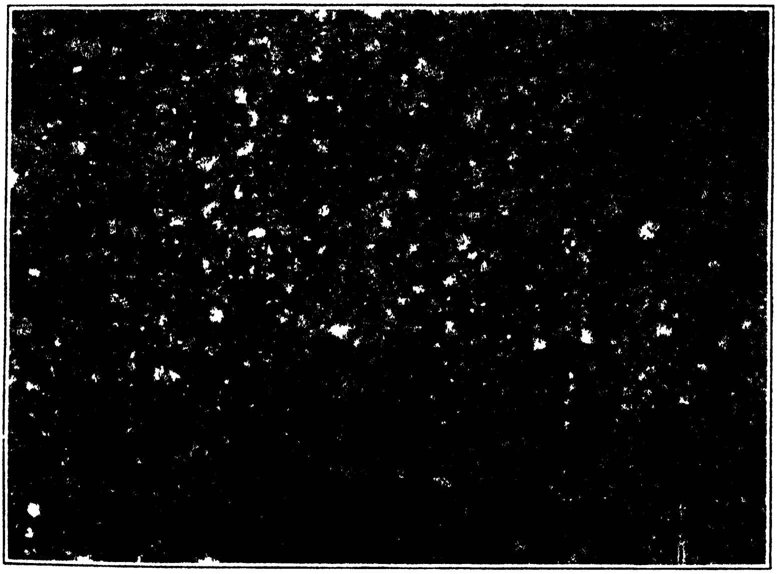
The small fragment (weight 40 grams) which Mr. Capps had saved and brought to the Museum, although badly oxidized, was sufficient to show at once its meteoric nature. On learning of its desirability Mr. Capps wrote to one of the parties mentioned and succeeded in securing the material here described in the form of a rough fragment of 280 grams weight.

Exteriorly the mass is so oxidized as to resemble an ordinary boulder of terrestrial limonite. A broken surface reveals an irregular sponge of metal with interstices of yellowish olivine of various sizes up to a maximum of 17 mm. in diameter. The metal bands are irregular, narrow, rarely over a few millimeters in width, and show in their maximum development the usual border of white iron (*wickelkamacit*) inclosing small areas of dull, plessitelike material, and the intervening plates of taenite. No Widmanstätten figures were developed by etching. The olivines are mostly angular in outline, and the structure, as shown in plate 2 is more that of a pallasite of the Brahin than the Krasnojarsk or Mount Vernon type, and so far as can be determined from the small scrap available, will be classed as of the Röckiky group, though the brecciation of the olivines is much less conspicuous than in the meteorites of Eagle Station or Admire.

The advanced condition of oxidation of the fragments renders a chemical analysis of doubtful value, and none has been attempted.

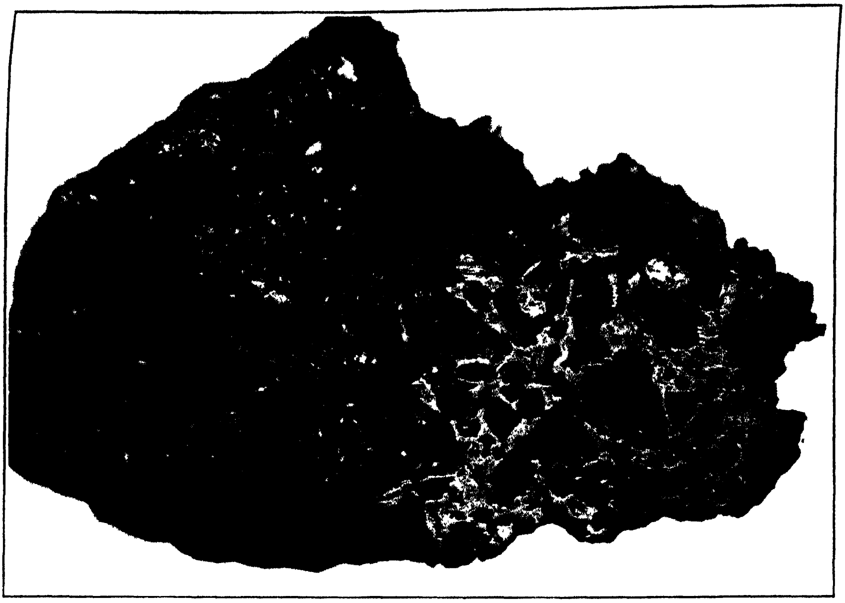


1 THE SIGNAL MOUNTAIN LOWER CALIFORNIA OCTAHEDRITE MAGNIFIED 2 DIAMETERS SHOWING IN THE UPPER LEFT SECONDARY GRANULATION

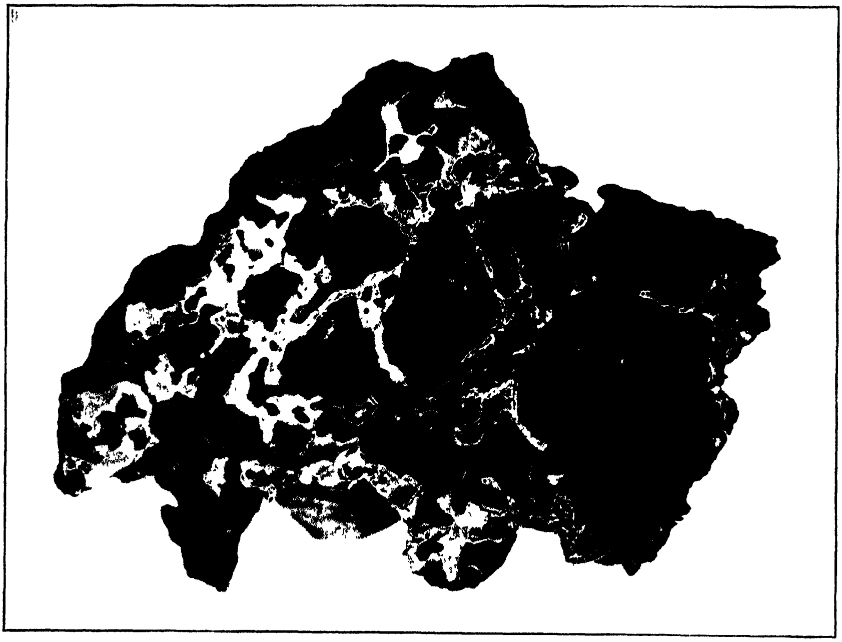


2 THE ALPINE TEXAS ATAXITE POLISHED SURFACE MAGNIFIED ABOUT 4 DIAMETERS

FOR EXPLANATION OF PLATES SEE PAGE 1 AND 2



1. THE COLD BAY, ALASKA, PALLASITE. BROKEN AND POLISHED SURFACES. ENLARGED ABOUT ONE-FOURTH.



2. THE COLD BAY, ALASKA, PALLASITE. POLISHED SURFACE. ENLARGED 2½ DIAMETERS.

FOR EXPLANATION OF PLATE SEE PAGE 3

CRINOIDS FROM THE UPPER CRETACEOUS OF TAMAULIPAS, MEXICO.

By Frank Springer.

Associate in Paleontology, United States National Museum.

The crinoid stems described in this paper were submitted to me by Dr. L. W. Stephenson, who collected them on two American-owned ranches, known, respectively, as Chocoy and Las Flores (or Manuel), on the line of the National Railways of Mexico, between Tampico and Monterrey, in the State of Tamaulipas, Mexico. The circumstances of the discovery of these and other Upper Cretaceous fossils are explained by Doctor Stephenson in Article 1 of this volume of the Proceedings.

These stem fragments apparently all belong to the genus *Balanocrinus*, which ranges from the Jurassic to the Upper Cretaceous—a form thus far known only by the stem, no other parts having yet been found. *Balanocrinus* falls under the family Pentacrinidae, which is characterized by a stem development far exceeding that of other crinoids, attaining in the typical genus, *Pentacrinus*, a length variously reported from 5 to 21 meters or 15 to 70 feet. These fragments are evidently remnants of stems of similar vigorous growth, as is indicated by the very large lateral cirri seen on some of them, and confirmed by the fact that one specimen, about 25 cm. or 10 inches long, is part of a stem which was traced in the rock for a distance of about 5 meters or 16 feet. *Balanocrinus* is distinguished from the more widely known *Pentacrinus* by the sculpturing of the joint faces at the line of union of the columnals, which here takes the form of crenelations around the outer edge of the joint face, and not along the sides of the petaloid sectors into which the central part of the face is divided. This character is thoroughly well marked in these specimens, and by it the occurence of the genus is proved for the first time in America to my knowledge. The extreme development of stem, although to be expected, has not before been so well shown in this genus.

Determination of species from the stem characters alone is unsatisfactory, because, while a definite stem structure is recognized for the genus, the minor details vary considerably in different parts of the same stem, and we have no means of ascertaining whether any of them are correlated with other characters so as to make them of specific value. However, as a record of the first known occurrence of the genus in America, and of the more full exhibition of the stem characters than has been hitherto available, it is advisable to describe it as a new species, for which I propose the name:

BALANOCRINUS MEXICANUS, new species.

Plate 1, figs. 1–11.

Known only from the stem. Stem cylindrical, large, and attaining a great length. A fragment 25 cm. long (pl. 1, fig. 1), here designated the type, tapers from 12 to 10 mm. in diameter, and the stem from which it was detached was more than 5 meters in length, traces of it having been seen for about that distance in the formation where it occurred. Other fragments range from 18 mm. diameter to 6 mm. The columnals vary from 2 to 4 mm. in length (relatively shorter in the larger stems), the shortest ones being the nodals, which occur at intervals of 17 to 20 ossicles, and bear strong cirri, either singly or two to each nodal, about opposite. The cirri are long and strong, two of them being preserved in place to lengths of 14 and 15 cm.; they taper from 4 to 2 mm. and have 48 and 52 ossicles, respectively; two others, somewhat displaced, are preserved to nearly the same length.

The cirrus sockets occupy the greater part of two ossicles, the nodal and a shorter supranodal or infranodal, separated by what is doubtless a syzygial joint, the characteristic structure of which can rarely be seen in the specimens; it is uncertain which of the two is uppermost, but from analogy with the living pentacrinoids it is probably the longer one, in which case figures 2, 3, 7, and 9 should be reversed.

The axial canal is circular and very small throughout; it is surrounded by five triangular depressed areas known as "petaloid sectors" (a term applied to these areas in the genus *Pentacrinus*, in which they are elongate and leaf-like), which are fossae for the lodgment of ligaments; these are separated by partitions connecting with the peripheral crenelated band that forms the contact surface of the stem ossicles; the septa are linear and well marked, and they sometimes appear as if divided by a median groove.

The circular area occupied by the ligament fossae varies in size in different parts of the stem[1] from one-third to one-half, or even two-thirds, the radius of the joint face, but usually about one-half. The radiating crenelations which extend continuously around the periphery of the joint face form a rather deep band, ordinarily about half the radius in width; they are usually about 10 to each sector, but are frequently reduced to 5. The sectors are rather deeply impressed when freely exposed, but in the specimens as here preserved are usually obscured by matrix.

---

[1] Springer, On the crinoid genus *Scyphocrinus*. Smithsonian Publication 2440, 1917, p. 37, pl. 8, figs. 2–5.

Occurrence and horizons.—Upper part of San Felipe formation and lower and upper parts of the Mendez formation of the Upper Cretaceous, at several localities on Chocoy and Las Flores ranches, 65 to 85 kilometers northwest of Tampico, in the State of Tamaulipas, Mexico, as enumerated below:

Upper part of San Felipe formation—Las Flores hacienda in an arroyo about 6 kilometers west by south of Manuel station (M. G. O. Acq. Nos. 138 and 268); and in an arroyo about 3½ kilometers west by north of Manuel station (M. G. O. Acq. No. 135); Chocoy hacienda, in an arroyo about 3 kilometers west-northwest of Chocoy station (M. G. O. Acq. No. 142); and in an arroyo four-fifths of a kilometer north of old Chocoy hacienda house (M. G. O. Acq. No. 143), and loose in material thrown from an excavation for a tank four-fifths of a kilometer south of old Chocoy hacienda house (M. G. O. Acq. No. 270).

Lower part of Mendez formation—On Chocoy hacienda, in a gully just west of the track of the National Railways of Mexico, 1⅗ kilometers northwest of Chocoy station (M. G. O. Acq. 141), and in a ditch along the Tampico road, half a kilometer south of the old Chocoy hacienda house (M. G. O. Acq. No. 271).

Upper part of Mendez shale—On Chocoy hacienda, in gullies at Los Borregas, 4 kilometers east by south of Chocoy station (M. G. O. Acq. No. 272).

The stem fragments are found through a vertical range of 200 or 250 meters. The type (pl. 1, fig. 1) was found in the upper part of the San Felipe formation, 6 kilometers west by south of Manuel station. Modifications of species doubtless occurred during the time interval represented by so great a deposit, but these can not be determined from the present material. A species was described by de Loriol from the Upper Cretaceous of Africa in Tunis[2] as *Balanocrinus africanus*, which was evidently a less robust form, having small cirri and more delicate crenelations on the joint faces.

Along with the stem fragments in the upper part of the Mendez formation are some remains of an echinoid with numerous very small spines, not sufficiently perfect for determination of the genus, but evidently of similar type to some forms which have been found in the Upper Cretaceous of Texas and Alabama.

---

[2] In Peron, Exploration scientifique de la Tunis, 1893. Paleontologie, pl. 31, figs. 39–53.

EXPLANATION OF PLATE.

All figures natural size unless otherwise indicated.

Balanocrinus mexicanus, new species.

FIG. 1. The type. Part of a large stem fragment 25 cm. long, 12 mm. to 10 mm. in diameter, belonging to a column traced in the rock to a length of 5 meters; it shows 3 complete internodes of about 20 columnals each, and a nearly complete cirrus about 15 cm. long, composed of 52 ossicles and tapering from 4.5 to 2 mm.; it also shows the origin of 2 opposite cirri from one nodal. The entire fragment from which the figure is made has 4 internodes, and 4 more or less complete cirri preserved. Acq. No. 268.

2. Stem fragment of about maximum diameter—17 mm.—showing 2 opposite cirrus sockets. Acq. No. 135.

3. Stem fragment containing 2 cirrus-bearing nodal columnals, of which the lower one has 2 cirri (one not visible, in this view) and the upper only one, with 16 internodals between them. Acq. No. 142.

4. Joint-face of same, showing triangular sunken areas of the ligament fossae, or petaloid sectors, having about the usual relative proportions, with crenelations limited to the peripheral band, about 10 to each sector. ×$\frac{3}{2}$.

5. Fragment of larger stem—15 mm. diameter. Acq. No. 135.

6. Joint face of same, with crenelation deeply exposed, showing alternate grooves rather strong, enclosing intermediate grooves which may sometimes be undeveloped, leaving less than 10 apparent in the fossil. ×$\frac{3}{2}$

7. Fragment of small stem, 6 mm. diameter, with a single cirrus socket. Acq. No. 138.

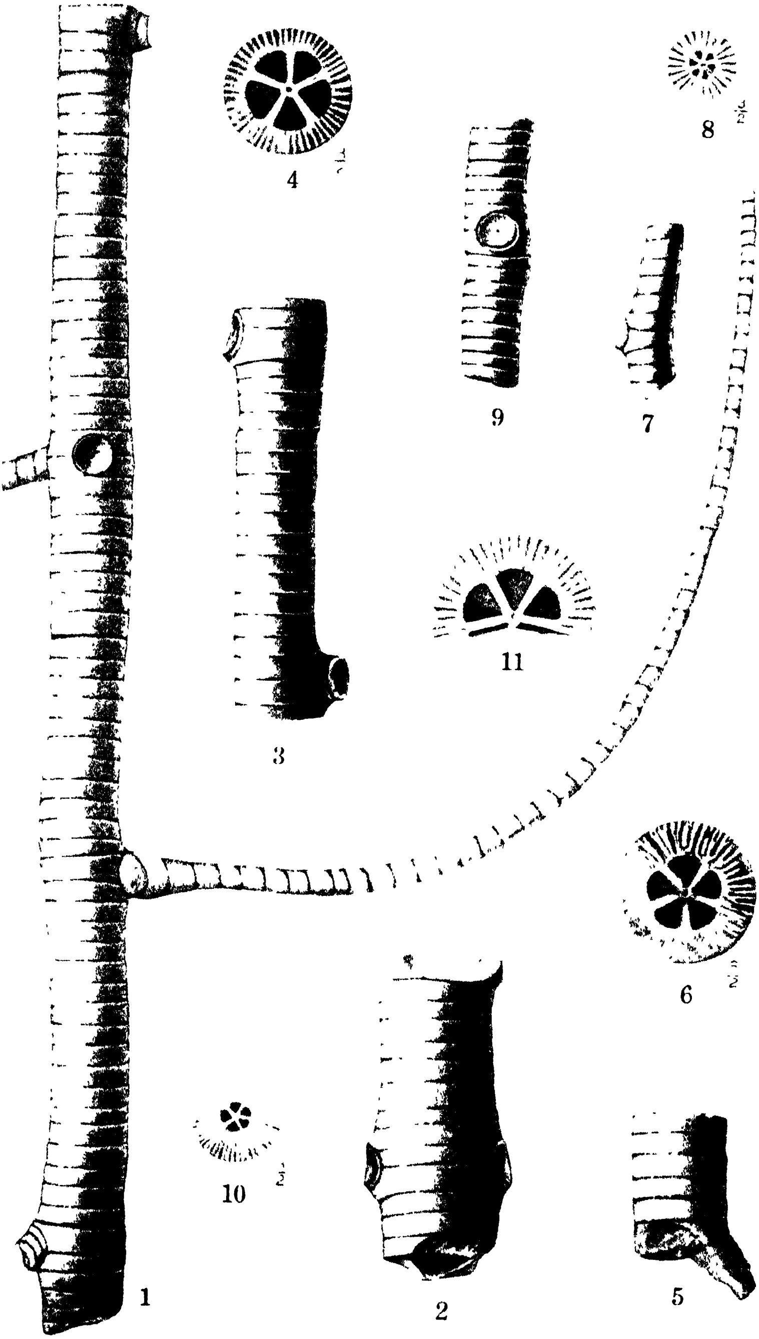
8. Joint-face of same. ×$\frac{3}{2}$.

All the foregoing from upper part of the San Felipe formation.

9. Stem-fragment 8 mm. diameter, containing a nodal columnal with a single cirrus. Acq. No. 147. Lower part of Mendez formation.

10. Joint-face of stem fragment 8 mm. in diameter, with petaloid sectors unusually small and crenate peripheral band correspondingly wide. ×$\frac{3}{2}$. Acq. No. 271. Same horizon.

11. Joint-face of large stem fragment, 14 mm. diameter. ×$\frac{3}{2}$. Acq. No. 271. Same horizon.



A NEW CRINOID FROM THE UPPER CRETACEOUS OF MEXICO.

FOR EXPLANATION OF PLATE SEE PAGE 4

STUDIES ON CHALCID-FLIES OF THE SUBFAMILY LEUCOSPIDINAE, WITH DESCRIPTIONS OF NEW SPECIES.

By Clara Jamieson Weld,
Volunteer Aid, Division of Insects, United States National Museum.

INTRODUCTION.

While arranging the collection of Leucospidinae and Chalcidinae in the United States National Museum, a number of undetermined specimens of *Leucospis* and related genera were discovered. In trying to determine these it became necessary to go over the literature of the group, and the present paper is an outgrowth of the work thus started on this interesting group of parasitic Hymenoptera. The study is based not only on the material in the National Museum, but an attempt has been made to assemble all the available unworked material in the other leading American museums, specimens being borrowed particularly from Cornell University and the Academy of Natural Sciences at Philadelphia. The types of several species in the latter institution have also been studied, so that the paper represents the results of studies on practically all of the material available in this country, comprising some 36 species. Of the 14 new species here described, one is from the United States, four from Central and South America, three from India, two from China and Japan, and four from the Philippine Islands and Straits Settlements.

The last comprehensive study of this group was made by Schletterer in 1890, and his monograph has been used as the basis for the present study. At the end of the paper will be found a list of the species described since 1890. These are arranged alphabetically by genera, with the locality indicated and with a short reference to the original description. In the bibliography which follows, a fuller citation is given and the papers are arranged chronologically under authors, bringing the literature from Schletterer to 1920. In the treatment of the various genera in the body of the paper, references have been omitted, the purpose being simply to supplement Schletterer's paper, which should be used in connection with this in the determination of unknown material. When genera have been put in synonomy by the author, the bibliography has been included.

The author is indebted to Mr. S. A. Rohwer, Custodian of Hymenoptera, for many suggestions during the progress of the study, as well as for notes on certain types in the Philadelphia Academy, subsequently confirmed by the writer on a visit to Philadelphia before the manuscript was submitted. Since there exists in literature some confusion regarding the names applied to various structures, it has become necessary to call attention to the general external morphology, and to make figures illustrating certain characters, which are used in the key. These figures are from drawings by the author.

Subfamily LEUCOSPIDINAE.

This subfamily of the Chalcididae resembled the subfamilies Podagrioninae and Chalcidinae in having greatly swollen hind femora, which are toothed or finely dentate beneath, large coxae, and strongly curved hind tibiae. It is wholly different from Podagrioninae, however, in the structure of head, thorax, and abdomen, and is readily distinguished from the Chalcidinae by the longitudinally folded front wings, larger pronotum, abdomen, elliptical or obovate in side view, from above usually swollen behind the middle, and by an ovipositor mostly longer than the abdomen and more or less reflexed over the dorsum. The subfamily is a natural one with distinct habits, being parasitic in the nests of bees. Its distribution is general but the species are more numerous in tropical countries. Black and yellow coloring predominates sometimes accompanied by metallic tints. Of the following genera given in the key, only *Leucospis* and *Epexoclaenoides* are represented in the United States National Museum. There are four other described genera of Leucospidinae, namely, *Exochlaenus* Shipp, *Micrapion* Kriechbaumer, *Exoclaenoides* Girault, and *Parexoclaenus* Girault, which are not recognized because in my opinion the descriptions of these do not contain characters of sufficient value to justify the establishment of new genera. In 1894 Shipp transferred *Leucospis anthidioides* Westwood to *Exochlaenus* Shipp, and stated in his description of the new genus his reasons for separating it from *Leucospis*. If one had only a few species of *Leucospis* for comparison the differences stated might well seem important, but in the light of species now available, the genus *Leucospis* becomes broader in scope and includes all of the characters noted by Shipp, with the exception of slightly longer front coxa and 11-segmented antennae, which seem to me specific rather than generic characteristics. Dalla Torre in 1898 recognized the genus *Exochlaenus* and Ashmead in 1904 included it in his table of genera of the subfamily Leucospidinae, separating it from *Leucospis* as follows: "Front coxae very elongate, nearly as long as their femora, the tibiae shorter than the femora; middle tibiae with a tooth at apex; hind tibiae curved and acutely produced into a spine at apex." Measurements made of five different species of *Leucospis* show the front coxa to vary from 0.66 to nearly 0.90 of the length of the front femur, while the front tibia is almost always shorter than the front femur, and in all cases the middle tibia has a spine at its apex (pl. 4, fig. 23). Kriechbaumer in 1894 established the genus *Micrapion* with *M. bilineatum*, an East African species, as the genotype. He based his separation from *Leucospis* upon the petiolate and pear-shaped abdomen. Instead of a new genus it seems more probable that Kriechbaumer had a species of *Leucospis* resembling *L. fülleborniana* Enderlein or *L. nyassica* Enderlein, both of which have slender petiolated abdomens and are described from the same region. In a recent paper Girault has described three new genera of Leucospidinae from Queensland, Australia. Two of these *Exoclaenoides* and *Parexoclaenus* fall within the genus *Leucospis* but the third, *Epexoclaenoides* possesses minute comb-like teeth on the under side of the hind femur, a character quite distinct from anything in the genus *Leucospis* (pl. 2, fig. 13). Unfortunately no definite idea is given of the shape of the abdomen of *Epexoclaenoides*. However, from a study made from five specimens in the United States National Museum, all of one species, from Bengal, India, which agree with the generic characters of *Epexoclaenoides* Girault, as far as given in the description of *E. bicinctus* Girault, it seems quite probable that the abdomen of this new genus is also different from *Leucospis* being only about twice as long as wide in side view and nearly globular behind the third tergite, as explained in the description of *Epexoclaenoides pyriformis*, new species.

KEY TO THE GENERA OF LEUCOSPIDINAE.

1. Vertex with two horn-like processes in front; posterior margin of head inwardly curved; third antennal joint shorter than second; pronotum tapering toward front, scutellum heart-shaped. West Africa___**Marres** Walker.
   Vertex without horn-like processes in front; posterior margin of head straight; third antennal segment as long as second, usually longer; pronotum of about equal width throughout; scutellum never heart-shaped ________________________ 2
2. Ovipositor limited to underside of abdomen, not even reaching end of same; abdomen more spindle-shaped, not compressed, bulging in middle with median longitudinal furrow toward posterior end of dorsum, apex pointed; central part of metathorax projecting; hind coxa with strong erect spur on upper margin. South America____________**Polistomorpha** Westwood.
   Ovipositor not limited to underside of abdomen but reaching partially or entirely around apex and usually reflexed forward over dorsum; abdomen compressed, apex rounded: hind coxa with or without a spur on upper margin ________________________ 3

3. Teeth on hind femur beneath less than twenty, distinct, never minute and comb-like; abdomen elliptical or obovate in side view, compressed apically; second and sixth tergites largest; femoral teeth variable in size and number; pronotum with or without carinae in front of its hind margin; antennae 12-segmented; labial palpi 3-segmented, maxillary palpi 4-segmented. Distribution general____________________**Leucospis** Fabricius.

Teeth on hind femur beneath more than twenty, very minute and comb-like; abdomen pear-shaped, nearly globular apically; sixth tergite large ____**Epexoclaenoides** Girault.

Genus MARRES Walker.

Genotype.—Marres dicomias Walker.

This genus, established in 1841 by Walker,[1] contains but a single species, which is known to the writer only from literature.

Genus POLISTOMORPHA Westwood.

Genotype.—Polistomorpha surinamensis Westwood.

Polistomorpha was founded in 1839 by Westwood as a subgenus of *Leucospis*, based on the single species *surinamensis*. In 1860 Walker made it a separate genus when he described *spegoides*. Besides these two, the following species have since been described, *fasciata* Westwood (1874) and *nitidiventris* Ducke (1906). A key to these four species is given by Ducke.[2] Cameron (1904) added *nigromaculata*, and another species is here transferred to this genus provisionally.

POLISTOMORPHA (?) BULBIVENTRIS (Cresson).

Leucospis bulbiventris Cresson, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 29.

The type in the Philadelphia Academy of Science is a male (Cat. No. 1776), which makes it difficult to assign definitely the species to this genus, as the writer has never seen any of the above species and males are known of only two. There is a faint carina in the yellow band on pronotum, hind margin of scutellum is slightly angled, propodeum twice as long as metanotum and with a median carina, hind femur with a large basal and about twelve small teeth. As the basal three-eighths of abdomen (segments two and three) is constricted into a petiole which is less than half the width of the bulbous distal part, the species is provisionally transferred to *Polistomorpha* in spite of the lack of a spur on hind coxa.

Genus LEUCOSPIS Fabricius.

Leucospis Fabricius, Syst. Ent., vol. 1, 1775, p. 361.
Genotype.—Leucospis dorsigera Fabricius.
Exochlaenus Shipp, Ent. Mo. Mag., vol. 30, 1894, p. 245.
Genotype.—Exoclaenus anthidioides (Westwood).

---

[1] Entomologist, p. 217.

[2] Bull. Soc. ent. France, 1906, p. 163.

Micrapion KRIECHBAUMER, Berl. Entom. Zeitsch., vol. 39, 1894, pp. 315–316.
Genotype.—Micrapion bilineatum Kriechbaumer.
Exoclaenoides GIRAULT, Mem. Queens. Mus., vol. 4, 1915, pp. 356–357.
Genotype.—Exoclaenoides uncinctus Girault.
Parexoclaenus GIRAULT, Mem. Queens. Mus., vol. 4, 1915, pp. 355–356.
Genotype.—Parexoclaenus vespoides Girault.

Since Schletterer's comprehensive work on this genus in 1890 thirty-three new species of *Leucospis* have been described, only two of which are found in the United States, while twelve of the others occur in South America. Because there is considerable confusion in literature in regard to the structural characteristics of this genus, the following morphological notes and figures are given in the hope that they may help to a clearer understanding of the structure as a whole, as well as being an aid in the use of the key and descriptions of new species included in this paper.

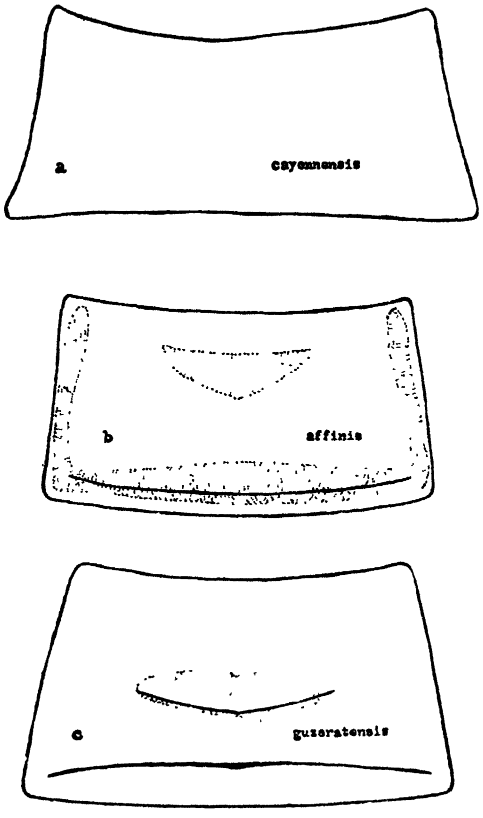


FIG. 1.—DIAGRAMS OF PRONOTUM OF LEUCOSPIS. *a*=CAYENNENSIS, WITHOUT ANY CARINA; *b*=AFFINIS, WITH ONE CARINA; *c*=GUZERATENSIS, WITH TWO CARINAE.

HEAD AND THORAX.—The head is usually transverse with antennae inserted at about the middle of the facial line as in *affinis* (pl. 2, fig. 6). Sometimes, however, the head is longer than wide, with antennae attached considerably above the middle of the facial line, as shown in *slossonae* (pl. 2, fig. 5). The eyes are more or less sinuate opposite the middle of the scape, the scapal furrows deep, highly polished, and transversely ridged within. The antennae are 12-segmented, with the club frequently showing one or two partial or entire sutures near its tip (pl. 1, fig. 4). The mouth parts are well developed, the mandibles 3-toothed, the maxillary palpi 4- and the labial palpi 3-segmented (pl. 2, fig. 8). The thorax is usually shorter than the abdomen, the pronotum large, being nearly as long as the mesoscutum and with or without carinae parallel to its hind margin. In *cayennensis* the pronotum has no carina (text fig. 1*a*), in *affinis* there is one distinct carina (text fig. 1*b*), and in *guzeratensis* (text fig. 1*c*) there are two well-marked carinae. The hind margin of the scutellum is always entire, the metanotum either broadly rounded behind as in *affinis* (text fig. 2*g* and *h*) or projecting and 2-toothed as in *gigas* (text fig. 2*e* and *f*), the propodeum is sometimes equal in length to the metanotum as in *affinis* or may be twice as long as the metanotum as in the case of *metallica* (text fig. 2*a* and *b*). The front leg bears the usual curved forked spine near the apex of tibia beneath, and the usual comb on its metatarsus, the middle tibia bears a slender straight spine on its under side near apex, while the hind tibia bears two spines at apex beneath, one of which is stouter than the other (pl. 4, fig. 23). The hind coxae and femora are much larger than those of the front and middle legs, the hind coxa sometimes has its dorsal margin broadly rounded and entire as in *cayennensis*, or may have a distinct tooth as shown in *affinis* (pl. 4, fig. 24). The femoral teeth are quite variable both in size and number; in *opalescens*, for example, the basal tooth is large and followed by eleven smaller, regular teeth (pl. 2, fig. 9) while in *affinis* the large basal tooth is followed

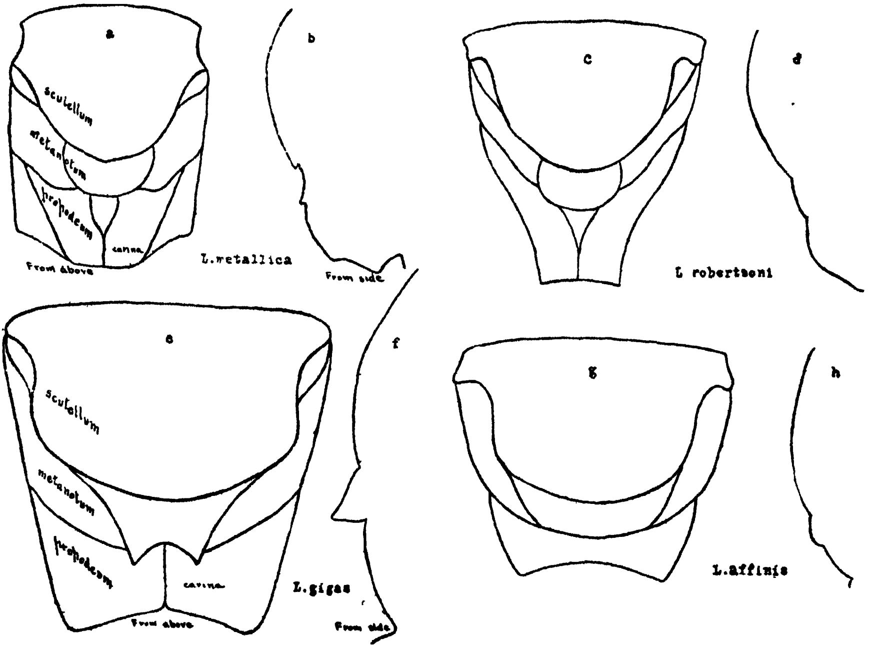


FIG. 2.—DIAGRAMS OF SCUTELLUM, METANOTUM, AND PROPODEUM OF LEUCOSPIS, VIEWED FROM ABOVE AND IN PROFILE. *a* AND *b*=L. METALLICA; *c* AND *d*=L. ROBERTSONI; *e* AND *f*=GIGAS; *g* AND *h*=AFFINIS.

by about nine smaller and often irregular teeth (pl. 2, fig. 12). In *slossonae*, on the other hand, there are but five large teeth, the first two long and sharp, the next two more blunt, and the last a broad 3-dentate tooth (pl. 2, fig. 10); still another arrangement of teeth is shown in *fuliginosa* (pl. 2, fig. 11), where the basal tooth is small and inconspicuous, the following five increasing in size with a broad 4-dentate tooth toward apex. The wings vary from hyaline to dark fuliginous in color, the subcostal and postmarginal veins are prominent, the radius and its branches short, leaving radial and cubital cells undeveloped, and there is only a trace of the median vein and its branches (pl. 1, fig. 2).

ABDOMEN.—The abdomen in *Leucospis* is composed of eight tergites not including the propodeum. The first is a narrow inconspicuous ringlike segment which forms a short constricted portion between the propodeum and the first apparent (second) tergite; this second tergite, which in some species is the longest, is always well developed and frequently has distinct sculpturing on its dorsal surface; the third and fourth tergites are usually constricted and telescoped together so that often the third is completely hidden but may be seen as a short segment in certain species, as for example in *gigas* and *indiensis* (pl. 3, figs. 15 and 19), while in *affinis* it is seldom visible except in dissection (pl. 1, fig. 3); the fourth and fifth tergites together are not as long as the second, while the sixth is usually the largest segment occupying most of the space between the constriction and the small crescent shaped spiracle-bearing seventh tergite; in *cayennensis* the sixth segment is about equal to the fifth and much shorter than the second, a proportion which is exceptional (pl. 3. fig. 17); the eighth tergite differs greatly in structure according to sex; in the female it forms a broad rounded portion, which consists of two similar halves reaching from near base on ventral side around apex, inclosing the ovipositor and its appendages which project from its tip (pl. 4, fig. 22); in the male the segmentation of tergites is less distinct than in the female, with more or less fusion between fourth, fifth, sixth, and seventh segments, and a small semicircular eighth segment at apex (pl. 4, fig. 26); the basal sternites in the female are short and inconspicuous, the hypopygium, which tapers toward its tip and is angled along median ventral line, occupying most of the ventral surfaces (pl. 1, fig. 1); the sternites in the male, on the other hand, are quite distinct (pl. 4, fig. 25). As a whole the male abdomen is more flattened and tapering toward the apex than the female. The ovipositor varies in *Leucospis* from a short upright spur near apex of abdomen to a long slender shaft which turns forward over the dorsum as far as the scutellum.

KEY TO THE SPECIES OF LEUCOSPIS FABRICIUS IN THE PRINCIPAL MUSEUMS OF THE UNITED STATES.

1. Pronotum without a transverse carina parallel to its hind margin (very faint in *texana*) ---- 2

Pronotum with one or two carinae parallel to its hind margin ---- 13

2. Ovipositor a short spur or reflexed dorsally reaching forward less than one-half length of abdomen ---- 3

Ovipositor reflexed dorsally, reaching forward more than one-half length of abdomen ---- 8

3. Hind femur with few large teeth; ovipositor a short erect spur, not reaching around apex of abdomen ---- 4

Hind femur with numerous small teeth; ovipositor reflexed dorsally around apex, extending forward less than one-half length of abdomen ---- 5

4. Spur between scapes prominent and coarsely sculptured like rest of face; median ocellus without parallel ridges on each side; space between lateral ocelli and eye not different in sculpture from rest of vertex, female 6.8 mm ---- 1. **slossonae**, new species.

Spur not so prominent and not so coarsely sculptured as rest of face; median ocellus with parallel ridges on each side; striae from lateral ocelli to compound eyes; yellow transverse band near hind margin of pronotum contains a faint carina, male 6.3 mm ---- 2. **texana** Cresson.

5. Wings fuliginous with transparent streak longitudinally through center ---- 6

Wings transparent, front edge lightly smoked ---- 7

6. Propodeum in median line twice as long as metanotum, median carina high, thin, abruptly angled behind, female 7.6 mm ---- 3. **metallica**, new species.

7. Occipital carina behind ocelli straight; united abdominal segments behind second much longer than second and longer than rest of abdomen; apical margin of sixth and following segments densely clothed with golden pile; ovipositor reaching to apical fourth of sixth segment; thorax metallic bronzy-green, without pale marking ---- 4. **sumichrasti** Cresson.

Occipital carina behind ocelli angulate forward; third, fourth, and fifth abdominal segments shorter than second or sixth; the apical margins of fifth and sixth with (rather feeble) band of silvery hair; ovipositor reaching to near base of sixth; thorax brownish black, the anterior and posterior margins of pronotum, sides and posterior margin of mesothorax yellow ---- 5. **tolteca** Cresson.

8. Ovipositor reflexed, reaching forward more than one-half length of abdomen, but not to its base ---- 9

Ovipositor reflexed, reaching forward beyond base of abdomen ---- 10

9. Propodeum with high angular median carina; hind coxa without spur on upper margin; pronotum reddish with dark spots, female 8.6 mm.
6. **robertsoni** Crawford.

10. Hind coxa without spur on upper margin, its surface mostly smooth and polished; propodeum densely hairy throughout; thorax strongly greenish iridescent, without yellow markings, female 10 mm.
7. **cayennensis** Westwood.

Hind coxa, with spur on upper hind margin, its outer surface entirely punctate ---- 11

11. Propodeum longer than metanotum in median line; hairy only at sides, hind femur fully twice as long as broad; pronotum red except for yellow band near hind margin, female 10.8 mm ---- 8. **opalescens**, new species.

Propodeum about equal to metanotum in median line; hind femur scarcely twice as long as broad ---- 12

12. Metanotum rounded at apex; pronotum bluish iridescent with touch of red near front margin and a transverse yellow band near hind margin; basal tooth of hind femur large followed by eleven smaller teeth, female 9.1 mm.
9. **elegans**, new species.

Metanotum truncate at apex; pronotum yellow with central area black, large basal tooth of hind femur followed by more than fourteen smaller teeth, female 8.7 mm -------- 10. **egaia** Walker.

13. Pronotum with one transverse carina parallel to its hind margin -------- 14

Pronotum with two transverse carinae parallel to its hind margin -------- 33

14. Ovipositor reflexed dorsally but not reaching hind margin of second (apparent first) abdominal segment -------- 15

Ovipositor reflexed dorsally, reaching forward beyond hind margin of second abdominal segment -------- 20

15. Metanotum two-toothed; propodeum entirely punctate with arched median carina; hind femur with large basal tooth followed by numerous smaller teeth, female 7.3 mm -------- 11. **biguetina** Jurine.

Metanotum rounded at apex; propodeum with polished light colored median spot, basal tooth (sometimes second tooth also) small, followed by three or four large free teeth and a broad four dentate one -------- 16

16. Hind coxa with spur or sharp angle on upper margin; punctures numerous on second abdominal tergite and separated by a space less than their diameter -------- 17

Hind coxa without spur; punctures few on second abdominal tergite and separated by a space greater than their diameter -------- 19

17. Large sharp teeth on hind femur preceded by two very small basal teeth; distinct spur on upper margin of hind coxa, female 11.5 mm.
12. **fuliginosa**, new species.

Large sharp teeth on hind femur preceded by one smaller basal tooth; hind coxa sharply angled on upper margin -------- 18

18. Oxipositor nearly touches front margin of sixth tergite; mesoscutum with punctures gradually becoming coarser behind; its posterior half not noticeably depressed; hind femur silvery pubescent, female 10.5 mm.
13. **indiensis**, new species.

Ovipositor only about three-fourths length of sixth tergite; mesoscutum with two types of sculpture, fine punctures on the arched anterior half and coarser punctures behind on the depressed flatter portion, the change of slope being marked by a narrow transverse nearly smooth area; hind femur mostly bare, female 12.7 mm -------- 14. **banksi**, new species.

19. Transverse carina in front of lateral ocelli; space between dorsal margin of scrobe and median ocellus about equal to diameter of ocellus, female 7 mm.
15. **pulchella** Crawford.

20. Basal tooth of hind femur small, followed by several large teeth; hind coxa without spur -------- 21

Basal tooth of hind femur large, followed by numerous teeth; metanotum rounded behind or at most with emarginate edge -------- 24

21. Metanotum distinctly two-toothed, large species -------- 22

Metanotum rounded behind, small species -------- 23

22. Ovipositor reflexed dorsally, reaching forward beyond hind margin of scutellum, female 10. mm -------- 16. **intermedia** Illiger.

Ovipositor reflexed dorsally (varies from middle of second tergite to base of abdomen) not reaching hind margin of scutellum; upper margin of hind coxa serrate posteriorly, female 12.4 mm -------- 17. **gigas** Fabricius.

23. Femoral teeth five; basal small, followed by three large well separated teeth and a broad tri-dentate portion; ovipositor reaches metanotum; face mostly yellow, female 6.5 mm ---------- 18. **ornatifrons**, new species.
24. Hind coxa with distinct spur on upper margin ---------- 25
    Hind coxa without spur (margin sometimes thin and serrate) ---------- 28
25. Propodeum with a transverse, sparsely punctate, polished, cushion-like area near its hind margin, female 10.5 mm ---------- 19. **decorata**, new species.
    Propodeum without sparsely punctate polished cushion-like area near its hind margin ---------- 26
26. Hind femur shining, its punctures separated by more than their width; pronotum almost entirely margined with yellow, female ---------- 20. **affinis** Say.[3]
    Hind femur dull, its punctures distinct but close and separated by a distance not greater than their width; at most only hind margin of pronotum yellow ---------- 27
27. Large (8.1–10.1 mm.); apical abdominal segment broadly yellow; anterior ventral margin of hind femur yellow; ovipositor extends to base of propodeum ---------- 21. **azteca** Cresson.
    Smaller (7.1 mm) apical abdominal segment black; hind femur unicolorous, brownish black; ovipositor extends to base of abdomen. 22. **dubiosa** Cresson.
28. Propodeum longer than metanotum in median line ---------- 29
    Propodeum equal to or less than metanotum in median line ---------- 30
29. Lateral carinae of propodeum absent and median carina not pronounced posteriorly; large light colored polished spot on outer surface of hind coxa; metanotum emarginate, female 8. mm ---------- 23. **hopei** Westwood.
    Lateral and median carinae of propodeum pronounced posteriorly, outer surface of hind coxa entirely punctuate, male 11.3 mm. 26. **japonica** Walker
30. Wings dark, except at apex ---------- 31
    Wings uniformly dark ---------- 32
31. Color uniformly brownish, the wings dark except at apex; hind femur coarsely punctured, basal tooth largest, then six rather small teeth of nearly uniform length before the fused double tooth; hind coxa not spurred, its upper posterior angle rounded and edge thin ---------- 24. **apicalis** Cresson.
32. Mesoscutum with yellow lateral markings; scutellum with yellow crescent-shaped marking posteriorly, female 8.7 mm ---------- 25. **orientalis**, new species.
    Mesoscutum and scutellum black, immaculate, female 12. mm. 26. **japonica** Walker.
33. Ovipositor reflexed dorsally, not reaching hind margin of second (first apparent) abdominal segment; abdomen in side view abruptly depressed behind ---------- 34
    Ovipositor reflexed dorsally reaching forward beyond hind margin of second (first apparent) abdominal segment; abdomen in side view straight along dorsal line ---------- 36
34. Anterior transverse carina of pronotum prominent, as high as posterior in median line; front wings not spotted at apex; second abdominal segment with smooth median line, female ---------- 27. **brevicauda** Fabricius.
    Anterior transverse carina of pronotum weak, much lower than posterior in median line ---------- 35

---

[3] "All markings bright fiery ferruginous or reddish yellow instead of yellowish white; head, without any metallic luster, etc." ---------- 20*a*. **affinis**, var. **floridana** Cresson.
Wings slightly yellowish; sculpture of abdomen somewhat closer and markings more extensive; pronotum practically all yellow, also scutellum; hind coxa and end of abdomen reddish (specimen determined by Cresson) ---------- 20*b*. **affinis**, var. **poeyi** Guérin.

35. Front wings faintly spotted toward apex; body richly marked with yellow; second tergite carinate along median line, female 7.5 mm. 28. **bakeri** Crawford.

Front wings strongly spotted toward apex; body markings duller and fewer; second tergite smooth but not carinate, female 8.3 mm. 29. **maculata**, new species.

36. Metanotum posteriorly produced, emarginate; body conspicuously marked with yellow; upper margin of hind coxa serrate; wings not iridescent, female 10. mm ---------------------------------- 30. **dorsigera** Fabricus.

Metanotum not produced, broadly rounded behind; upper margin of hind coxa almost entire; wings purplish iridescent ---------------------------37

37. Ovipositor does not reach to middle of second (apparent first) tergite----38

Ovipositor reaches beyond middle of second tergite ----------------------39

38. Occipital carina wanting behind eyes; hind femur 1.75 times as long as wide; basal tooth broad and rather blunt, followed by nine teeth, female 11.2 mm ----------------------------- 31. **bengalensis**, new species.

39. Medium size (9.1 mm.); abdomen hairy, without any conspicuous marking on sixth tergite; an irregular whitish band on hind femur near base, female 9.1 mm ------------------------------ 32. **guzeratensis** Westwood.

Large (12.5–14.5 mm.); abdomen with only scattered pubescence; conspicuous yellow transverse band on sixth tergite ------------------------40

40. In front view lateral ocelli hidden; scutellum and hind femora immaculate, female 14.5 mm ---------------------------------- 33. **kreigeri** Enderlein.

In front view lateral ocelli plainly visible; scutellum and hind femora marked with yellow, female 12.5 mm ------------ 34. **robusta**, new species.

1. LEUCOSPIS SLOSSONAE, new species.

The manuscript name of *slossonae* given this species (male and female) by Ashmead has been retained in the following description. It is closely related to *texana* Cresson, having a long narrow face; obovate abdomen; short spur-like ovipositor and large semicircular hind femur, but differs in sculpture of face; darker color of wings; body markings and teeth on under side of hind femur. There is no transverse carina on pronotum in either sex of *slossonae* while in *texana* both male and female have a faint carina.

Female.—Length 7.4 mm. *A short robust species with reddish markings; face long and narrow; ovipositor very short; teeth on hind femur few and large.*

Body black with following parts reddish-orange: scape; first six segments of flagellum especially on underside; two small dots on vertex near lateral margin of scrobe; wide band on posterior half of pronotum which extends forward laterally as two large spots; narrow longitudinal stripes on mesoscutum above tegulae; spot beneath base of front wings; crescent-shaped band on scutellum; metapleurae; base of femora and all of tibiae on fore and middle legs; central part of hind coxae on outer side; all of hind femora except a dark spot on outer and inner side of basal half and the black teeth; hind tibiae, with the exception of a dark stripe, on inner side; tarsi; a broad transverse spot, emarginate behind on the second tergite; a narrow band, angulate forward in median line, near central part of sixth tergite; ovipositor.

Head narrower than thorax behind pronotum; face black finely rugoso-punctate with scattered pubescence on frons and vertex; line from median ocellus to lower edge of clypeus nearly 1.5 times interocular space; malar space one-fifth length of eye; distance across scapal furrows at base three times distance from margin of furrow to eye; spur between scapes prominent and rugoso-punctate like rest of face; eyes sinuate; median ocellus without transverse parallel ridges on each side; space between lateral ocelli and eyes not different in sculpture from rest of vertex; postocellar distance 1.5 times ocellocular; occipital carina prominent medially, disappearing behind eyes (pl. 2, fig. 5); antennae robust 12-segmented; scape about as long as first three segments of flagellum; pedicel nearly as long as first funicular segment; second funicular twice as long as first; fourth and fifth subequal; sixth to eleventh becoming stouter; twelfth conical.

Pronotum without transverse carinae, reticulate-punctate, narrower in median line than mesoscutum; scutellum more coarsely punctate than mesoscutum, the punctures becoming shallower toward hind margin which is broadly rounded; lateral foveae of metanotum divided into pits by longitudinal striae, hind margin smooth and polished; central part of metanotum bulging and coarsely punctate, its apex rounded; propodeum twice as long as metanotum in median line, coarsely rugoso-punctate, with stout median keel, strong lateral carinae and long whitish hairs on spiracular area; coxae of front and middle legs dark, hairy on outer surface; hind coxae dark toward base, the femoral groove mostly smooth and highly polished; hind femora finely punctate above, becoming smooth and polished beneath, about 1.5 times as long as broad, with five large teeth on ventral edge, three of which are widely separated, the fourth crowded but broad and distinct and followed by a shorter tridentate tooth; the first two free teeth are long, slender, and sharp pointed, the following two blunter at apex (pl. 2, fig. 10). Fore wings fuliginous except a narrow longitudinal streak through center which is nearly transparent; hind wings paler; veins brown.

Abdomen about equal to thorax in length, widest near middle of sixth segment, depressed toward apex, strongly compressed ventrally, forming a wedge-shaped outline in cross-section; second segment broadest behind; grooved along median line except at base, which is ridged with a cup-shaped depression on either side; following three segments short, together about one-fourth length of second; sixth large, about twice length of second, strongly depressed behind; apex rounded; ovipositor a short erect spur reaching only to hind margin of sixth tergite (pl. 3, fig. 14).

Male.—Length 7.0–8.5 mm. Body black with markings similar to female except reddish band on sixth abdominal segment is broader and of equal width throughout, and there is sometimes a small reddish spot on median line toward apex. The abdomen is more pointed posteriorly and has a smooth depressed area in the position of ovipositor in female. On hind femur there is just a trace of a basal tooth preceding the five large teeth.

Described from 17 specimens, all but 2 of which were collected in Florida.

Type.—Cat. No. 24381, U.S.N.M. Type female, allotype, three female and six male paratypes.

One female and two male paratypes in collection of Academy of Natural Sciences, Philadelphia; one male and one female paratypes in collection of Cornell University; one male paratype in Museum of Comparative Zoology, Cambridge, Massachusetts.

Habitat.—Type-locality, Capron, Florida, April 14.

Allotype from Biscayne Bay (Slosson); paratypes from Capron, Biscayne Bay, Orlando (March 18, 1908, Russel), Miami (March 5, 1915), Gulfport (August, Renolds), Paradise Key (Mosier), Metacomba Key (March, 1898, Collins and Pollard), Tampa, Florida; and Tifton, Georgia.

2. LEUCOSPIS TEXANA Cresson.

This species was described from two male specimens collected in Texas (Belfrage). The type is in the Academy of Natural Sciences, Philadelphia, Cat. No. 1776, and has been seen by the writer. It lacks antennae beyond the fourth segment. The United States National Museum has the paratype, Cat. No. 1659.

3. LEUCOSPIS METALLICA, new species.

On account of its short ovipositor, absence of carina on pronotum and numerous small teeth on under side of hind femur, this species runs close to *tolteca* Cresson in Schletterer's key, but shows distinct differences in sculpture of propodeum, character of pubescence on abdomen, and in color markings.

Female.—Length, 7.6 mm. *A small iridescent species with high keeled propodeum, golden pubescence toward apex of body, and ovipositor reaching less than half the length of abdomen.*

Body black with metallic tints of green and purple and few yellowish markings as follows: faint spotting on scape laterally, narrow transverse line near hind margin of pronotum obsolete at sides; slightly broader band on hind margin of mesoscutum; indistinct markings near base of femora above and under side of tibiae on front and middle legs; upper and lower margins of hind femora, except for a short distance at apex; outer side of hind tibiae. Legs, except where mentioned, inclined toward rufous, also area on hind coxae above.

Head nearly as wide as hind margin of pronotum; face finely longitudinally rugose-punctate, short pubescent; line from median ocellus to level of clypeus 1.2 times interocular distance; malar space one-fifth length of eye; clypeus truncate on edge; postocellar area nearly twice ocellocular; vertex broad, closely punctate; iridescent; distance across scapal furrows at base about three times distance from margin of furrow to eye; occipital carina prominent, angulate forward; eyes only slightly sinuate; antennae piceous, 12-segmented, slightly ferruginous beneath; first funicular segment only slightly longer than pedicel, second about twice first; third, fourth, and fifth subequal, rest becoming stouter, apical segment conical with indistinct suture near tip.

Pronotum contiguous punctate, without a transverse carina near its hind margin; mesoscutum about 1.3 times length of pronotum; scutellum without yellow markings, apex broadly rounded; metanotum with parallel longitudinal ridges in foveae separated by deep punctures, its lateral margins broad and polished, apex crescent-shaped with margin smooth entire and slightly upturned; propodeum twice as long as metanotum in median line, with high thin median heel obliquely angulate behind, lateral carinae prominent (text fig. 2*a* and *b*). (Paratype specimen has a high arched median carina.) Hind coxa evenly punctate above, upper margin thin and sharply angled, but without spur; hind femur 1.7 times longer than wide, closely punctate, its basal tooth beneath broad, blunt, and followed by eleven smaller teeth, the first six of which are distinctly separated, the rest smaller and crowded close together. Fore wings fuliginous, except for a hyaline streak longitudinally through center; hind wings slightly paler.

Abdomen about length of head and thorax together, densely pubescent behind fourth tergite, the hind margins of fifth and sixth fringed with hairs and apex covered with long golden pubescence; seen from above the fourth tergite is slightly constricted, the sixth swollen and the apex compressed; seen from the side the dorsal line is arched. Ovipositor reflexed over dorsum to a little beyond middle of sixth tergite, its groove reaching to apex of fifth.

Described from two specimens. Type female, one female paratype.

Type.—Cat. No. 24382, U.S.N.M.

Habitat.—South America: Sao Paulo. (December 12 and 26, 1902, Beron.)

4. LEUCOSPIS SUMICHRASTI Cresson.

Described from one female collected by Professor Sumichrast in Mexico.

Type.—Cat. No. 1798 in the Academy of Natural Sciences, Philadelphia, where it has been seen by the writer.

5. LEUCOSPIS TOLTECA Cresson.

Described from four females and one male collected in Mexico by Professor Sumichrast.

Type.—Cat. No. 1801 in the Academy of Natural Sciences, Philadelphia, where they have been seen by the writer.

6. LEUCOSPIS ROBERTSONI Crawford.

Leucospis robertsoni CRAWFORD Proc. Ent. Soc. Wash., vol. 11, 1909, pp. 51–52.

Described from one female and two males from Southern Florida. Diagram of scutellum, metanotum and propodeum shown in text, figure 2 *c* and *d*.

Type.—Cat. No. 12581, U.S.N.M.

7. LEUCOSPIS CAYENNENSIS Westwood.

This species is represented in the United States National Museum by nine females collected from the following localities: Brazil, Santarem; Panama, Corazal, Canal Zone (June 11, Busck), Porto Bello (Mar. 19, 1911, Busck), Tabernilla, Canal Zone (July 23, 1907, Busck); Guatemala, Livingston (Barber and Schwarz), Cayuga (February, Schaus and Barnes), (Oct. 15, Schaus); Honduras (Mann). The Academy of Natural Sciences, Philadelphia, has a female from Costa Rica (June 21, 1903, Crawford), which the writer has determined as this species.

Diagram of pronotum shown in text, figure 1(*a*); abdomen on plate 3, figure 17; hind coxa on plate 4, figure 24.

8. LEUCOSPIS OPALESCENS, new species.

In Schletterer's key this species runs nearest to *cayennensis* Westwood, because of its long ovipositor and the absence of transverse carinae on the pronotum, but the two are so different in general appearance that they could not be confused. It also resembles *robertsoni* Crawford, from which it differs in having a low median keel on the propodeum and a spur on the upper margin of hind coxa. In Roman's key to South American species it runs to *equia* Walker, but has a wider propodeum, a different shaped metanotum, and a more rotund hind femur. In structure it is most closely related to *formosifacies* Strand, an Argentine species. There are, however, such distinct differences in coloration that a separation seems advisable.

Female.—Length 10.8 mm. *A reddish irridescent species richly marked with yellow; ovipositor longer than abdomen; hind coxa with prominent spur on upper margin.*

Body parti-colored with red, green, and purple metallic tints and *yellow markings, as follows: Scape; transverse band near hind margin of pronotum, interrupted at median line*; band on hind margin of mesoscutum; two conspicuous pear-shaped lobes connected in median line on hind margin of scutellum; semicircular spot on metanotum; triangular area on mesopleurae; broad interrupted band near hind margin of second tergite; narrower band on sixth parallel to its posterior margin and turned forward on sides below; irregular crescent-shaped markings just behind spiracles and similar markings near apex of abdomen; narrow stripes on front femora and on middle tibiae, with an elongate spot on upper margin of middle coxae; a stripe on upper margin of hind coxa and a spot near base on lower side; band along dorsal margin of hind femur, a line just above teeth on ventral margin, which broadens to include large basal tooth, continues to base of femur, and forms on under side a broad central band to apex. Legs, except where mentioned, reddish-brown; tibial spurs yellow; ovipositor rufous with almost black tip; antennae reddish-brown.

Head as wide as pronotum, wider than abdomen; copper-colored with rich metallic luster, finely rugosely punctate, short pubescent; distance from median ocellus to lower edge of clypeus a little longer than the interocular space; malar space one-third length of eye; clypeus emarginate, mandibles 3-toothed; antennocular space greater than interantennal; eyes sinuate, ocelli transparent; occipital carina distinct, continuous behind eyes; scape more than twice as long as broad, first funicular segment tapering toward base, 1.5 times pedicel; second funicular longest, fourth, fifth, and sixth subequal, seventh to twelfth becoming stouter. Pronotum reddish copper-colored, finely reticulate-punctate, without transverse carina; mesonotum and mesopleura brilliantly iridescent with greenish purple tints; mesosternum polished; scutellum more coarsely punctate than mesoscutum, broadly rounded at apex; foveae of metanotum striately punctate, apex crescent-shaped, slightly projecting with smooth upturned nearly transparent margin; propodeum slightly longer than metanotum in medium line, much longer at sides, its median carina low, its hind margin finely, shallowly, punctate with apex emarginate; spiracular areas surrounded by long whitish hairs. Hind femora shining, densely punctate, 2.3 times as long as broad, basal tooth on under side large, long, forward of middle and followed by eleven smaller black teeth (pl. 2, fig. 9); hind coxae closely punctate, with thin blunt transparent spur on upper margin toward base. Fore wings subhyaline, fuliginous along front margin and at apex; hind wings nearly transparent, veins brown.

Abdomen setigerous punctate, 1.5 times longer than head and thorax together, second tergite 1.3 times as long as wide, with two furrows above on either side on median line, which diverge toward triangular polished spot at base; area between furrows arched, with narrow polished median line; third and fourth tergites short, constricted; fifth scarcely one-fourth length of sixth; sixth shorter than first, swollen toward middle, its dorsal surface greenish iridescent; apex of abdomen strongly compressed. Ovipositor flattened toward apex, reaches a little beyond middle of propodeum.

Described from one female collected at Chapada in March.

Type.—Cat. No. 24383, U.S.N.M.

Habitat.—Brazil; Chapada.

9. LEUCOSPIS ELEGANS, new species.

In Roman's key this species runs to *egaia* Walker, from which it differs in shape of metanotum, femoral teeth and in color markings. It also resembles *opalescens*, new species, but shows distinct differences in length of propodeum, shape of metanotum, wider hind femora and in general coloration.

Female.—Length 9.1 mm. *An iridescent species with yellow markings, pronotum without transverse carina, hind coxae spurred and ovipositor longer than abdomen.*

Body varicolored, ground color dark with blue-green and red metallic tints and yellow markings as follows: transverse complete band near hind margin of pronotum; shorter incomplete band of similar width on hind margin of mesoscutum; narrow band near hind margin of scutellum; median crescent-shaped spot on metanotum; triangular spot on mesopleura beneath tegula; faint oblique line on metapleura; stripes on front legs along upper and lower margins of femur, inner surface of tibia; apex above and half of margin beneath of middle femur and under side of tibia; narrow stripe along upper margin of hind coxa, which covers spur, and spot near base beneath; broad band on lower front margin of hind femur, which extends from base nearly to apex and covers large basal tooth, band along upper margin narrowing toward base and an elongated spot near apex beneath; broad band on hind margin of second tergite interrupted in median line; a band of about same width on seventh, which extends over a small portion of eighth segment in median dorsal line. Scapes are rufous in color, as are also the tegulae and front margin of pronotum, especially at sides and near middle. Legs, except where mentioned, rufous to dark brown.

Head brilliantly iridescent with garnet, gold, and green tints; face finely rugosely punctate, short pubescent; line from median ocellus to level of clypeus only slightly longer than interocular space; malar distance about one-third length of eye; clypeus sinuate at edge; eyes sinuate; vertex broad closely punctate, postocellar space 1.6 times ocellocular; occiput concentrically striate below, carinate above; antennae broken at third segment; scape more than twice as long as wide, first funicular segment 1.2 times pedicel.

Pronotum contiguous punctate without transverse carina; mesoscutum about 1.5 times length of pronotum in median line; scutellum broadly rounded behind; foveae of metanotum contain parallel ridges with depressions between, hind margin of metanotum finely punctate laterally almost to edge, which is narrowly polished, apex crescent shaped, slightly projecting over propodeum, with upturned edge; propodeum about equal to metanotum in median line, much longer laterally; spiracular area covered with long silvery hairs. Hind coxa with outer surface entirely punctate, a broad, thin blunt spur on upper margin toward apex; hind femur 1.8 times as long as wide, basal tooth large, margined and followed by eleven smaller teeth, the first six well separated from each other, the rest becoming crowded. Fore wings subhyaline, clouded along costal margin and toward apex with paler streak through central area; hind wings paler.

Abdomen a little longer than head and thorax together, seen from above constricted in fourth tergite, swollen in sixth, and compressed toward apex; seen from side view abdomen is straight dorsally and broadly rounded at apex; second segment of abdomen is nearly 1.3 times as long as wide, with two furrows above, which diverge toward base and are separated by a dull median carina; third, fourth, and fifth segments short, sixth shorter than second segment. Ovipositor reaches nearly to middle of propodeum.

Described from one female loaned by Cornell University.

Type.—At Cornell University.

Habitat.—South America: Argentine, La Rioja (E. Giacomelli).

10. LEUCOSPIS EGAIA Walker.

Leucospis egaia Walker, ROMAN, Arkiv. f. Zool., vol. 12, no. 19, 1920, pp. 8-9.

Type of this species a female collected by Mr. Bates at Ega, Brazil, is in the British Museum. The United States National Museum contains one female from Obidos, Amazonas (H. Rolle), determined from literature as this species.

11. LEUCOSPIS BIGUETINA Jurine.

One female in the United States National Museum obtained through exchange from Cornell University (Lot 326. Sub. 2). Abdomen shown on plate 3, figure 18.

12. LEUCOSPIS FULIGINOSA, new species.

In Schletterer's key this species runs close to *micrura* Schletterer, but differs in shape of face, comparative length of antennal segments, form of hind femur and character of femoral teeth.

Female.—Length 11.5 mm. *A shining black and yellow species with fuliginous wings, ovipositor less than half the length of abdomen and basal tooth of hind femur inconspicuous.*

Yellow markings on body as follows: upper half of scape; front and hind margins of pronotum strongly, lateral margins weakly; transverse crescent-shaped spot near middle of mesoscutum and lines above tegulae; large bilobed marking near hind margin of scutellum; a median spot on propodeum; wedge-shaped spot on metapleura; two conspicuous marks on outer side of hind femur, one of which extends from base to second tooth, the other from apex along upper margin about half way; short lines near apex of hind tibiae opposite spurs; most of dorsal surface of second tergite, except toward base; a wide transverse band near hind margin of sixth tergite which narrows laterally. Front and middle legs and tibiae and tarsi of hind legs inclined toward rufous.

Head as wide as pronotum; face finely rugosely punctate, short pubescent; line from median ocellus to level of clypeus 1.1 longer than greatest distance between eyes; malar space 0.22 length of eye; vertex broad closely punctate with polished striated area about median ocellus and on either side of lateral ocelli; clypeus sinuate with small polished tooth in median line; eyes slightly emarginate; postocellar space 1.5 times ocellocular, occipital carina distinct; antennae 12-segmented slightly ferruginous at apex, first funicular segment 1.5 times pedicel, third and fourth subequal, rest becoming stouter, apical segment conical with faint concentric rings near tip.

Pronotum contiguous punctate with faint transverse wrinkles in median line near anterior margin, and a nearly complete transverse carina parallel to its carinate hind margin; mesoscutum about 1.4 times length of pronotum in median line, densely umbillicate punctate; scutellum broadly rounded behind, its apex smooth and shining; foveae of metanotum parallel ridged, punctate between ridges, hind margin polished laterally, apex rounded, punctate; propodeum nearly twice as long as metanotum, median keel prominent with area on either side polished and coarsely punctured; rugosely punctate toward lateral carinae, spiracular areas pubescent. Hind coxa punctate except in femoral groove which is mostly smooth and polished toward apex, dorsal margin has small notched spur behind middle. Hind femur 1.8 times as long as wide, setigerous punctate, its first two basal teeth small and followed by four long, sharp, widely separated teeth and a broad 4-dentate portion (pl. 2, fig. 11); hind tibiae with apex produced into a strong prominent spur from inner edge of which projects a slender spine; front and middle claws pectinate, hind claw simple with few minute teeth at base. Fore wings uniformly fuliginous, veins dark brown.

Abdomen slightly longer than head and thorax together; seen from above constricted in fourth segment, swollen near middle of sixth and strongly compressed toward apex; seen from side abdomen is straight along dorsal line to about middle of sixth tergite, then is sharply depressed toward apex. Groove of ovipositor reaches base of sixth segment, while ovipositor itself reaches only three-fourths length of same segment.

Described from one female loaned by Cornell University (Lot 322).

Type.—At Cornell University.

Habitat.—Japan.

13. LEUCOSPIS INDIENSIS, new species.

This species resembles *similis* Enderlein, male, but differs in having a faint transverse carina on the pronotum, no smooth area in middle of the mesonotum, silver pubescence on face, deeply fuliginous wings and no yellow markings on scutellum, mesonotum, or hind coxae. It differs from *similis* Enderlein, var. *feminina* Strand in color markings, slightly longer ovipositor and in size and arrangement of teeth on under side of hind femora.

Female.—Length 10.5 mm. *A slender black species with whitish markings; a conspicuous polished spot on propodeum; ovipositor about one-half length of abdomen; wings fuliginous.*

Body black with whitish markings as follows: narrow transverse bands near front and hind margins of pronotum; smooth polished median area on posterior half of propodeum; two small triangular spots on sides of second abdominal segment near hind margin; a narrow band near hind margin of sixth segment, and two lines on upper side of apical segment near median line; short narrow stripe near apex on upper side of front femora and along outer basal half of tibiae; small spots at base and apex of middle tibiae; a broad band irregular in width, which begins near basal tooth of hind femur and extends across front and along upper margin to apex; a stripe along outer side of hind tibiae from base to apex.

Head a little wider than front margin of pronotum; base black, densely covered with silvery pubescence, finely rugosely punctate; eyes sinuate; line from median ocellus to level of clypeus 1.1 times interocular; malar space nearly one-fourth length of eye; distance across scapal furrows at base 2.3 times the distance from margin of furrow to eye; vertex broad, closely punctate with polished striated areas on either side of lateral ocelli; postocular space 1.3 times ocellocular; occipital carina distinct medianly, disappearing behind eyes; antennae 12-segmented, scape twice as long as broad; first funicular segment 1.5 times pedicel; third, fourth, and fifth subequal, longer than wide, rest becoming stouter.

Pronotum transversely rugosely punctate, with one faint transverse carina covered by the whitish posterior band; anterior whitish band follows margin of pronotum and is distant about twice as far from front margin as the other band from hind margin; mesoscutum longer than pronotum in median line; scutellum coarsely punctate, broadly rounded behind, its margin shining; foveae of metanotum punctate between parallel longitudinal striae, hind margin smooth and highly polished, apex rounded; propodeum twice as long as metanotum, polished spot divided by the low median keel, lateral carinae convergent behind, spiracular areas silvery pubescent; hind coxa mostly punctate, smooth polished area extends from apex along upper margin which is sharply angled but without spur; hind femur twice as long as wide, finely densely punctate above with silvery pubescence, nearly smooth beneath, its under margin armed with a small short basal tooth, followed by three (left femur) or four (right femur) long, sharp, widely separated, stout teeth and a less distinct broad 4-dentate tooth. Fore wings fuliginous with violaceous lustre and a transparent streak longitudinally through center; slight metallic iridescence; hind wings hyaline except anterior apical area beyond radius, which is fuliginous and slightly violet tinted; veins brown.

Abdomen hairy, about length of head and thorax together, reddish toward base; seen from above narrow in front of middle, swollen behind middle and compressed toward apex; seen from side view broadest through middle, depressed apically; second segment scarcely broader behind, longer than wide with median polished line; third, fourth, and fifth segments short, about equal in median line; sixth segment much swollen, as long as second, third, fourth, and fifth segments together; apex rounded (pl. 3, fig. 19). Ovipositor nearly touches front margin of sixth tergite, its groove deeply cut.

Described from one female received from Ramakrishna Ayyar and recorded under his number. Collected January 28, 1913, by Ponniah.

Type.—Cat. No. 24384, U.S.N.M.

Habitat.—South India: Coimatore.

14. LEUCOSPIS BANKSI, new species.

This species closely resembles *indiensis*, new species, but has the following differences in color markings, sculpture of mesoscutum, and length of ovipositor.

Female.—Length 12.7 mm.

Body markings cream colored; spot on apical half of scape: stripe on upper side of front femur extends more than half its length, while stripe on tibia covers whole outer side; middle femur has spot at apex, middle tibia dark only on under side; broad band on hind femur more even in width than in *indiensis*, median spot on propodeum less distinct; small spots on sides of second tergite absent, also narrow band near hind margin of sixth tergite and spots on apical segment near median line; stripe on metapleura not found in *indiensis*; meso-

scutum is depressed in posterior half with traces of parapsidal grooves, the boundary between arched and depressed regions being marked by a narrow transverse sparsely punctate area, which separates the finely punctate anterior portion from the coarsely punctured posterior region; scutellum more sparsely punctate at base than in middle and hind portion; median keel of propodeum weak behind; hind femur on outer side finely punctate, polished and mostly bare; wings darker than in *indiensis* with violaceous luster more pronounced.

Abdomen less hairy than *indiensis*, the reddish color extending from base over sixth tergite; groove of ovipositor reaches almost to front margin of sixth tergite but ovipositor only 0.77 length of this segment.

Described from one female received from C. S. Banks (December 1, 1919).

Type.—Cat. No. 24385, U.S.N.M.

Habitat.—Philippine Islands, Los Baños.

15. LEUCOSPIS PULCHELLA Crawford.

Leucospis pulchella CRAWFORD, Philippine Journ. Sci, vol. 9, No. 5, sec. D. 1914, p. 457.

Described from one female received from C. F. Baker from Los Baños, Philippine Islands.

Type.—Cat. No. 18401, U.S.N.M.

16. LEUCOSPIS INTERMEDIA Illiger.

The United States National Museum contains one female, collected in Southern France, which has been determined by the writer, from literature, as this species. Cornell University has one female which has been available for study.

17. LEUCOSPIS GIGAS Fabricius.

This species is represented by three females in the United States National Museum, one from Sicilia (1858, Mann); one from Ragusa (1868, Mann); and one from Italy (1886, Magretti). Cornell University has one female of this species, and the Museum of Comparative Zoology at Cambridge three females (Imhoff collection), all of which the writer has seen. Diagram of scutellum, metanotum, and propodeum shown in text figures 2*e* and *f;* abdomen shown on plate 3, figure 15.

18. LEUCOSPIS ORNATIFRONS, new species.

This Philippine species resembles *erthrogastra* Cameron quite closely, but differs in size, color markings, and teeth on under side of hind femur.

Female.—Length 6.5 mm. *A small species with conspicuous yellow marking on face, one transverse carina on pronotum, five teeth on hind femur, and ovipositor longer than abdomen.*

Body black with yellow markings as follows: scape; two large distinct kidney-shaped markings on face reaching from vertex nearly to lower level of eyes; small indistinct spots beneath insertion of antennae and obscure spot on clypeus; broad transverse bands near front and hind margins of pronotum, the former dilated at ends; marks above tegulae; two conspicuous spots near center of mesoscutum, large bilobed marking on apex of scutellum; front half of meso- and metapleurae; two faint spots on metanotum near median line; front and middle coxae beneath; apical outer half of front femur; apex of middle femur; nearly whole of front and middle tibiae; spot on upper margin of hind coxa at base and smaller spot near apex below; outer side of hind femur except teeth and a central reddish-brown area which touches margin near apex and between first and second teeth and a spot near apex beneath; apical half of hind tibiae above; two large triangular spots on second tergite, transverse band on fifth, another on sixth which becomes wider on sides beneath, obscure marking over spiracle and two crescent-shaped markings near median line on apex; tarsi. Antennae and legs except where mentioned rufous.

Head transverse, face rugosely punctate, short pubescent; line from median ocellus to lower edge of clypeus about equal to greatest distance between eyes; malar space 0.22 length of eye; distance across scapal furrow at base about twice the distance from margin of furrow to eye, clypeus and spur between scapes more finely punctate than rest of face; eyes only slightly sinuate; postocellar space 1.8 times ocellocular; occiput concentrically striate with prominent carina angulate forward above; antennae stout, 12-segmented, scape longer than following two segments, pedicel and first funicular segment about equal, third, fourth, and fifth subequal, rest becoming stouter toward apex, club conical with suture near tip.

Pronotum shorter than mesoscutum in median line, with a transverse carina parallel to its hind margin; front half of thorax bent downward so that head assumes a position almost parallel to abdomen; scutellum broadly rounded behind; metanotum with hind margin smooth and polished, its foveae parallel-ridged, punctate between ridges, its apex slightly depressed; propodeum about equal in length to metanotum in median line, twice as long on sides, median carina wanting, lateral carinae prominent, spiracular areas hairy; hind coxa punctate except on upper half toward apex where it is smooth and polished, upper margin bluntly rounded at base becoming thin in apical half but without a distinct spur; hind femur closely setigerous punctate, 1.7 times as long as wide with five teeth on its lower margin the basal small and sharp, the following three much larger (second and third sharp, fourth blunt at tip) and the last a short, broad tridentate tooth. Fore wings hyaline, clouded along front margin and toward apex; hind wings clear; veins dark brown.

Seen from above abdomen is about 2.5 times as long as widest part, second tergite largest, third covered, fourth and fifth shorter than sixth, apex compressed; viewed from side the abdomen is straight along dorsal line, widest behind middle with apex broadly rounded. Ovipositor reaches metanotum.

Described from one female received from C. S. Banks.

Type.—Cat. No. 24386, U.S.N.M.

Habitat.—Philippine Islands, Manila.

19. LEUCOSPIS DECORATA, new species.

In Schletterer's key this species runs to *azteca* Cresson, but differs from Cresson's type in sculpture of propodeum and in color markings.

Female.—Length 10.5 mm. *A slender shining dark brown species with yellow markings, hind coxae densely hairy, and ovipositor longer than abdomen.*

Body with pale yellow markings as follows: apical half of scape beneath; transverse band near hind margin of pronotum; lateral margins of mesoscutum; transverse band near hind margin of scutellum; apex of metanotum, irregular band on hind margin of propodeum; oblique stripe through central part of metapleurae with spot on upper apical margin; line on apical two-thirds of front tibiae beneath; spot near apex of middle tibiae; lower margin of hind femora broadest at base and extended as a narrow line nearly to apex and upper margin, except near base; broad transverse band near hind margin of second tergite; narrower band near hind border of sixth tergite; two conspicuous crescent-shaped marks on apex, one on either side of ovipositor. Tegulae, spots on pronotum at sides near hind margin, area beneath tegulae, hind coxae, tibiae, tarsi, and ovipositor, except tip, reddish brown.

Head as wide as pronotum behind; face finely rugosely punctate, with metallic green and purple luster, especially on vertex and occiput; line from median ocellus to level of clypeus 1.1 times longer than greatest distance between eyes; malar space 0.25 length of eye; postocellar distance 1.3 times ocellocular; eyes sinuate opposite middle of scape; occiput transversely striate-punctate, with low carina above; antennae piceous, slightly ferruginous beneath and at tip, 12-segmented, first funicular segment about twice as long as pedicel, third, fourth, and fifth funicular segments subequal, rest becoming stouter, apical segment conical with two faint concentric sutures near tip.

Pronotum contiguous punctate with one transverse carina parallel to its carinate hind margin; mesoscutum about 1.5 times as long as pronotum; scutellum with a transverse sparsely punctate polished band near its smooth, broadly rounded apex; hind margin of metanotum rounded, its foveae finely reticulate punctate within, with margins highly polished; propodeum about length of metanotum in median line, median and lateral carinae absent, transverse area near hind margin mostly bare and highly polished, spiracular area pubescent; hind coxa setigerous punctate, the hairs long and silvery, upper margin with a slender, sharp spur; hind femur nearly 2.5 times as long as wide, densely punctate except on yellow areas, where punctures are scattered and shallow, basal tooth on under side large and prominent, followed by a row of 10 smaller teeth, the first of which is small and inconspicuous, the next four increasing in size and well separated, the remaining five becoming smaller and crowded; front and middle claws pectinate; hind claws simple, with a few minute spines at base. Wings fuliginous, pale behind, veins brown.

Abdomen seen from above is constricted behind second tergite, swollen through sixth and compressed apically; the second segment is about 1.5 times longer than wide, its median surface elevated, smooth and polished but not carinate; seen from side view abdomen is longer than head and thorax together, with straight dorsal line and apex broadly rounded. Ovipositor reaches apex of scutellum, its tip black and compressed.

Described from two female specimens.

Type.—Cat. No. 24387, U.S.N.M. Type and paratype.

Habitat.—Type locality; Costa Rica: Juan Vinas (Schaus); Paratype, Guatamala: Amatillan (February, 1912).

20. LEUCOSPIS AFFINIS Say.

Leucospis affinis, Say, GRAENICHER, Bull. Wisc. Nat. Hist. Soc., n. s., vol. 4, 1906, pp. 153–159, 1 pl.

This is the commonest and best-known species in the United States (pl. 1, fig. 1) and the only one whose habits and life history have been studied in detail (Graenicher, 1906). It is widely distributed and is represented in the United States National Museum from the following localities: Massachusetts, Southampton (July 14, 1894); Connecticut, Hartford (July 12, 1896), Lyme (June 28, 1915); Pennsylvania, North East (July 8, 1916, Cushman), Highspire (June 27, 1908, Fisher), Carlisle Junction (July 1, 1909, Walton), Inglenook (June 20, 1909, Myers); Virginia, Vienna (July 27, 1912, Cushman), Falls Church (September 1, 1915, Greene) (September 15, 1917, Champlain), East Falls Church (June, 1916, Rohwer), Rosslyn

(Smith); Washington, D. C. (September 15, 1878, Cresson determination); Maryland, Beltsville (June 25, 1915, Shannon); Texas, Dallas (July 3, 1907, Cushman) (September 4, 1907, Pierce), Devils River (May 5, 1907, Bishopp), Sweet Water (Bishopp); Indiana (Baker); Illinois, Algonquin (Baker); Wisconsin; Kansas, Riley County (September, Marlatt); Minnesota; Colorado (Baker); Arizona, Hot Springs (June 26, Barber); New Mexico, Las Cruces (Cockerell); California, Los Angeles (Coquillet); Oregon, Ashland (March 31, 1919, Sergent); Canada (Baker).

The Academy of Natural Sciences, Philadelphia, has representatives of this species from: New Jersey, Lawnside (September 3, 1904), Mount Pleasant (August, 1908), Riverton (August 2); Pennsylvania, Pike County (July, 1910); Maryland, Chesterton (August 10, 1901, Vanatta); Illinois; Georgia, Tifton; New Mexico, Alamogordo (May 13, 1902); Washington.

In the Museum of Comparative Zoology, Cambridge, there are specimens from Maine, Brunswick; White Mountains (Packard); Massachusetts, Taunton, Tyngahore (Blanchard), Scituate (August 28, 1906, Morse); New York, Ithaca (July), Sea Cliff (August); Maryland, Chesapeake (July 9, Banks); Virginia, Falls Church (June, July, August, Banks); and from Texas.

The Boston Society of Natural History has five Harris specimens: One female and two males, New Hampshire (36), July 23, 1835; one male (36), locality not given; one female, North Conway, N. H. (August 15, 1851). Also 16 other specimens from Maine, Bar Harbor (male, July 24, 1919, Johnson), Wales (female August, Frost); Massachusetts, Wellfleet (male and female, August 16, Johnson), Rutland (male and female, July 9 and 31, Johnson), Gloucester (female, July 8, Johnson), Cohasset (female, September 13, 1907, Bryant), Manomet (male, June 26, 1905, Johnson), Auburndale (female, July 22, Johnson); Vermont, Norwich (female, July 8, 1908, Johnson), Bennington (male, June 21, 1915, Johnson); Rhode Island, Tiverton (female, July 31, 1913, Johnson).

The writer has also examined specimens of *affinis* from Cornell University, collected from New York, Crosby Landing, Lake Keuka (June 26, 1914), Ithaca (July 4, 1914), Potsdam; Pennsylvania, Roberts (July 4, Bradley); Nevada, Lyon County (July 27, 1909).

20 (a). LEUCOSPIS AFFINIS, var. FLORIDANA Cresson.

This variety of *affinis* is represented in the United States National Museum by two specimens, a female from Jacksonville, Fla., and a male from Key West (Mar. 7, 1898). The writer has consulted Cresson's type (female) and paratype (male) in the Academy of Natural Sciences, Philadelphia.

20 (b). LEUCOSPIS AFFINIS, var. POEYI Guérin.

Two specimens (male and female) of this variety from Cuba, determined by Cresson, have been seen by the writer in the Academy of Natural Sciences, Philadelphia. The yellow markings are more conspicuous than in *affinis*. In the female the propodeum is not as long as the metanotum, while in the male it is about twice as long.

LEUCOSPIS BICINCTA Viereck.

Leucospis bicincta VIERECK, Trans. Amer. Ent. Soc., vol. 32, 1906, p. 227.

"Readily distinguished from all other American species by the pale citron-yellow, almost whitish, markings and the two bands on the abdomen, one being basal, the other in the middle.

"*Male.*—5 mm. Structure, sculpture, and color pattern, with the exceptions mentioned as in *affinis*. Upper portions of front and occiput and vertex strongly green, scape and next succeeding joint black, the joint beyond this brown (remaining joints broken off), legs black, with the following parts concolorous with the other pale markings; tips of the femora, anterior and posterior tibiae in front and middle tibiae with the upper half in front, tarsi pale brown, claws dark brown, wings faintly infuscated, the nervures black or nearly.

"*Type.*—University of Kansas.

"*Type-locality.*—Oak Creek Canon, 6,000 feet, Arizona.

"One specimen collected in July by F. H. Snow, Arizona."

The type of this species has not been seen by the writer, but from an examination of three female specimens collected in Arizona, which have almost white markings instead of yellow and which run in the key to *affinis*, it seems quite probable that *bicincta* may be a color variety of *affinis*.

21. LEUCOSPIS AZTECA Cresson.

Described from three specimens collected in Mexico by Professor Sumichrast.

Type.—Cat. No. 1799 and two paratypes in the Academy of Natural Sciences at Philadelphia. Seen by writer. There is one carina on pronotum; propodeum about width of metanotum, with narrow yellow band near its hind margin, punctate like rest of propodeum; hind coxa is well covered with grayish hairs and has sharp spur on upper margin; seventh tergite yellow; apex of abdomen except along line of ovipositor yellow.

22. LEUCOSPIS DUBIOSA Cresson.

Described from one female collected by Professor Sumichrast in Mexico.

Type.—Cat. No. 1800 in the Academy of Natural Sciences, Philadelphia. Examined by writer.

23. LEUCOSPIS HOPEI Westwood.

This species, said to be the most common *Leucospis* in Chile, is represented by three specimens in the United States National Musuem, two of which, female and male, were collected by E. C. Reed in Chile; the third specimen is a male of unknown locality.

24. LEUCOSPIS APICALIS Cresson.

Described from two specimens collected by Professor Sumichrast in Mexico. Seen by the writer. Shape of body resembles that of *cayennensis*, but is without metallic luster; carina near hind margin of pronotum prominent, angulate forward in median line; ovipositor reaches scutellum; tips of wings broadly hyaline.

Type.—Female, Cat. No. 1797 in the Academy of Natural Sciences, Philadelphia.

25. LEUCOSPIS ORIENTALIS, new species.

In Schletterer's key this species runs close to *affinis* Say, from which it differs in color pattern, absence of metallic luster on head, and absence of spur on upper margin of hind coxa. It is also related to *japonica* but differs in smaller size and in having yellow markings on mesoscutum and scutellum.

Female.—Length 8.7 mm. *A medium sized black species, without metallic luster, abdomen marked with a yellow band across middle and a broad yellow band in front and behind, hind coxa without spur on upper margin.*

Body black with following parts lemon yellow: Scape; three irregular spots near front margin of pronotum and a transverse band which covers carina near hind margin; short lateral lines on mesoscutum above tegulae; bilobed spot near hind margin of scutellum; a broad interrupted band on second abdominal segment, a narrow band on fifth, a broad band on sixth, and two oval spots on apex; a triangular spot on metapleura; upper margin of hind coxa tapering toward apex, and a spot near base beneath; a large crescent-shaped marking near base of hind femur, one horn of crescent extending along upper margin and almost coalescing with spot at apex; base and apex of hind tibia; under side of front and middle tibiae and apices of front and middle femora; tarsi.

Head nearly as wide as hind margin of pronotum, face finely rugosely punctate, covered with short pubescence; line from median ocellus to level of clypeus 1.1 times interocular space; malar distance about one-fourth length of eye, clypeus sinuate with tooth in median line; distance across scapal furrows about twice the distance from margin of furrow to eye; vertex broad flat, postocular distance 1.4 times ocellocular; occipital carina distinct above, disappearing before reaching eye; antennae 12-segmented, first funicular segment about

1.6 times pedicel, second, third, and fourth nearly equal, rest of segments becoming stouter toward apex; apical segment conical with two faint concentric rings close to tip.

Pronotum closely setigerous punctate, with one nearly complete transverse carina parallel to its margined hind border; mesoscutum more coarsely punctate than pronotum, scutellum broadly rounded behind; foveae of metanotum longitudinally striately punctate with polished hind margin, apex of metanotum rounded, its punctures few and deep; propodeum only about half as long as metanotum in median line, much broader at sides, rugosely punctate with strong lateral carinae and low inconspicuous median keel; hind coxa evenly punctate, without a spur on upper margin; hind femur less than twice as long as wide, finely punctate with twelve teeth on under margin, the first of which is largest, the following two short but well separated. the next four increasing in size, the remaining becoming smaller and semifused. Fore wings uniformly fuliginous, veins brown; hind wings somewhat paler.

Abdomen seen from above swollen behind middle, seen from side broadest posteriorly with dorsal line straight; second tergite unusually long, being 0.4 of whole abdomen; fourth and fifth together about one-fourth of second, while sixth in median line is 0.4 of first; median line of second tergite is smooth and highly polished with furrows on either side which diverge toward smooth truncated area at base; no medial groove is visible on fourth, fifth, and sixth tergites. Ovipositor reaches nearly to metanotum.

Described from one specimen received from N. Gist Gee.

Type.—Cat. No. 24388, U.S.N.M. Type female.

Habitat.—China: Soochow.

26. LEUCOSPIS JAPONICA Walker.

Leucospis japonica Walker, ASHMEAD, Journ. New York Ent. Soc., vol. 12, no. 3, 1904, p. 147.

The United States National Museum contains three specimens, a female from Gifu, Japan (Y. Nawa), a female from Soochow, China (N. Gist Gee), and a male received from Doctor Mitsukuri, Gifu, Japan, which is evidently the specimen from which Ashmead described the male of this species and erroneously assigned a type number. (Cat. No. 7151, U.S.N.M.)

27. LEUCOSPIS BREVICAUDA Fabricius.

One female in the United States National Museum which was loaned for study by Cornell University and later obtained through exchange. (Abdomen shown on pl. 3, fig. 21.)

28. LEUCOSPIS BAKERI Crawford.

Leucospis bakeri CRAWFORD, Philippine Journ. Sci., vol. 9, no.5, Sec. D, 1914, pp. 457–458.

The type, female, is in the United States National Museum, Cat. No. 18402. In his description of the female of this species, Crawford states "male unknown." Since the publication of his description (1914) the United States National Museum has received from C. F. Baker an additional female and one male collected at the type locality, Los Baños, Philippine Islands. It has also received a female taken by E. A. McGregor (June, 1918), at Cuias Panay, Philippine Islands (later sent to Cornell University through exchange) and a female collected at Manila, Philippine Islands, by C. S. Banks.

The following description of the male of this species is given to supplant the original description.

Male.—Length, 5 mm. Resembles female of species in structure and coloration with following differences: smaller size, rufous color more suppressed; subquadrate reddish spot on disk of mesoscutum and median reddish spot on propodeum wanting, as are also the two large yellow spots on second abdominal segment, and the two small yellow spots on the spiracle-bearing (seventh) segment near apex ("fourth" of Crawford). Instead of the two elongated spots on apex of female, one on either side of the ovipositor, the male has a single large median spot on apex. There are two transverse yellow bands on the male abdomen as in the female, the front band somewhat farther behind the narrow constricted portion of the abdomen than in the female, the posterior band in about the same relative position, but not dilated so much laterally. In the type, female, there are nine smaller teeth (Crawford says about six) following the large basal tooth on hind femur, and there are probably the same number in the male, although only eight are distinguishable, on account of the position of the tibia, the last three of which are much crowded.

Habitat.—Philippine Islands, Los Baños.

29. LEUCOSPIS MACULATA, new species.

In Schletterer's key this species runs nearest to *brevicauda* Fabricius, but differs from it in having a large fuscous spot toward apex of fore wing, in arrangement of teeth on ventral side of hind femur, and in color markings.

Medium size; black with yellowish markings; ovipositor about one-half length of abdomen; fore wing with fuscous spot near apex.

Female.—Length, 8.3 mm. Body black with following parts reddish yellow: Scape; a transverse band near front margin of pronotum which dilates into triangular spots laterally; a broader band on hind margin which covers the posterior transverse carina; small spots above tegulae; a transverse band near hind margin of scutellum; a small spot on middle of metanotum; two narrow transverse bands on abdomen, one on constricted portion (third, fourth, and fifth tergites) and the other near posterior margin of sixth tergite; small spot on metapleura below hind wing; a streak on dorsal margin of hind coxa; spot at base and band along upper margin of hind femur; upper margin of hind tibia and all of tarsal joints; whole of first and second legs except coxae.

Head as broad as pronotum; vertex flat, broad, densely punctate; frons narrowest opposite insertion of antennae; face silvery pubescent; line from median ocellus to lower edge of clypeus 1.1 times interocular distance; antennocular space less than interantennal; malar space one-sixth length of eye; scrobes deep, converging above, margin carinate, cavities striate; triangular spur between scapes has polished median carina; eyes slightly emarginate; postocellar space 1.5 times ocellocular; occipital carina weakly angulate forward; antennae gone except first three segments of one; scape cylindrical more than twice as long as wide. Pronotum has two transverse carinae in front of its hind margin, the posterior prominent and almost complete, the anterior much weaker, extends only short distance on either side median line; mesoscutum slightly longer than pronotum, coarsely rugoso-punctate; scutellum broadly rounded behind; lateral foveae of metanotum setigerous punctate, with smooth polished hind margins; apex projecting, strongly depressed at margin; propodeum twice as wide as metanotum, rugosely punctate, with arched median keel and strong lateral carinae; spiracular area covered with long whitish hairs. Hind coxae finely punctate without a spur on upper margin; hind femora a little over twice as long as wide, with broad blunt basal tooth on lower edge followed by twelve small teeth of which the third, fourth, and fifth are largest; hind tibiae arcuate with two distinct spurs at apex; fore wings subhyaline, darker along front margin and with large fuscous spot near apex; hind wings nearly transparent.

Abdomen seen from above constricted in front of middle, swollen behind constriction and compressed toward apex; seen from side the dorsal line is wavy, with elevations in second and sixth segments and with posterior half of abdomen strongly depressed. Second tergite longer than broad, about half the length of sixth, not carinate medianly but with a smooth shining line which broadens toward its hind margin. Ovipositor reaches three-fourths the distance to base of sixth tergite, its groove deeply cut and V-shaped at tip.

Described from two females received from C. F. Baker.

Type.—Cat. No. 24389, U.S.N.M. Type and paratype.

Habitat.—Island of Penang.

30. LEUCOSPIS DORSIGERA Fabricius.

Genotype.—The United States National Museum contains six representatives of this species from the following localities: female, St. Pauls, Tirol (1887, Schletterer); female, male, Transkauk, Helenendorf (1886); male, France; male, Italy (1880, Magretti); male, Bozen (1883).

Cornell University has three females and two males from Tangier, also a female and male the localities of which are not given. (Abdomen shown on pl. 3, fig. 16.)

31. LEUCOSPIS BENGALENSIS, new species.

This species resembles *guzeratensis* Westwood, in having two prominent transverse carinae on the pronotum, dark wings with purple iridescence, hind coxa without a spur and metanotum broadly rounded at apex; but differs in shorter ovipositor, lower occipital carina, shape of hind femora and in color markings.

Female.—Length, 11.2 mm. *A somber species with carinate pronotum, dark wings, hind coxa without spur and ovipositor reaching three-fourths length of abdomen.*

Body black with following few yellow markings: apical two-thirds of scape beneath; a transverse spot near center of pronotum, the hind margin of which covers the front carina; small spot on upper corner of hind coxa at base; narrow stripe on apical half of hind tibiae above; small spots on sides of fifth tergite. (In paratype specimen spots on hind coxae are wanting and there are two small dots near hind margin of sixth tergite, one on either side of median line.)

Face black covered with silvery pubescence; line from median ocellus to level of clypeus 1.1 times interocular space; malar space about one-third length of eye; clypeus sinuate at edge with small tooth in median line; spur between scapes carinate; postocellar space 1.6 times ocellocular; vertex broad; median and lateral ocelli visible from behind; occipital carina distinct medianly disappearing behind eyes; antennae 12-segmented, first funicular segment 1.2 times pedicel; third, fourth, and fifth subequal, the rest becoming stouter toward apex.

Pronotum transversely rugoso-punctate, about the same length as mesoscutum, with two distinct carinae parallel to its hind margin which is also carinate; while both carinae are prominent in median line, the anterior extends only a short distance laterally, the posterior about three-fourths the distance to margin; scutellum coarsely punctate, the punctures deeply striate at apex, which is broadly rounded with smooth margin; foveae of metanotum longitudinally ridged with punctures between the ridges, hind margin polished laterally, apex bluntly rounded; propodeum rugoso-punctate, only slightly longer than metanotum, median keel low, lateral carinae prominent, apex emarginate. Hind coxa closely punctate above, without spur on upper margin; hind femur 1.7 times as long as wide, with a row of ten teeth on lower margin, the basal tooth broad and rather blunt, the second smaller, the next four increasing in size, the remaining four decreasing and becoming semifused. Wings uniformly fuscous with purplish iridescence, veins dark brown.

Abdomen a little longer than head and thorax together; seen from above slightly constricted in fourth segment, swollen near middle of sixth, compressed toward apex; seen from side view broadest behind, dorsal lines straight, apex broadly rounded; second tergite 1.1 longer than wide and about one-third the length of whole abdomen. Ovipositor reflexed over dorsum reaches beyond apex of second segment nearly one-fourth length of same, while its groove extends almost to base of abdomen.

Described from two females.

Type.—Cat. No. 24390, U.S.N.M. Type and paratype.

Habitat.—*Type locality*, India: Bengal (June 1, 1906, T. V. R. A. Pusa Coll. 27); paratype from Behar (September, 1907, G. R. Dutt. Pusa Coll. 28).

32. LEUCOSPIS GUZERATENSIS Westwood.

The United States National Museum contains one female from South India: Coimbatore (Aug. 6, 1912, T. V. R.). (Pronotum shown in text fig. 1c).

33. LEUCOSPIS KREIGERI Enderlein.

Leucospis kreigeri ENDERLEIN, Archiv. f. Nat., vol. 1, Heft 3, 1901, pp. 215–216.

There is one female of this species in the United States National Museum which was received from B. P. Clark, New Guinea.

34. LEUCOSPIS ROBUSTA, new species.

In Schletterer's key this species runs near *guzeratensis* Westwood, but differs in larger size, shape and depth of oviposital groove, color markings and in a more swollen abdomen. It is related also to *kreigeri* Enderlein, from which it differs in shape of vertex, position of lateral ocelli, and in presence of yellow markings on scutellum and hind femora.

Female.—Length 12.5 mm. *A large black species with dark purplish iridescent wings, abdomen rufous toward base, pronotum strongly carinate, and ovipositor nearly as long as abdomen.*

Body black with following parts yellow: Scape; short transverse band in front of carinae on pronotum, notched in median line behind; narrow band on hind margin of scutellum slightly broader toward ends; spot on upper basal margin of hind coxa, and spot near apex beneath; spots near base and apex of hind femur; upper margin of hind tibia; small spot near apex of femur and base of tibia on front and middle legs; band near hind margin of sixth tergite, interrupted at median line and tapering laterally. Legs and base of abdomen more or less rufous.

Head nearly as wide as hind margin of pronotum; face finely rugosely punctate, covered with short silvery pubescence; clypeus emarginate with tooth in median line; lower tooth of mandible sharp pointed, second tooth broad and blunt; line from median ocellus to level of clypeus a little longer than interocular space; malar space about one-fourth length of eye; distance across scapal furrow at base over twice the distance between furrow and eye; postocellar space 1.5 times ocellocular; vertex broad. flat, closely punctate with polished striated areas on either side of lateral ocelli; occipital carina distinct only slightly bent forward in median line; antennae piceous, 12-segmented, first funicular segment about twice length of pedicel, following four segments nearly equal, the rest becoming stouter toward apex.

Pronotum has two prominent, polished carinae parellel to its hind margin, which is also carinate; both carinae incomplete, the anterior reaches only a short distance on either side of median line; mesoscutum evenly, densely punctate; scutellum broadly rounded, hind margin smooth and polished; foveae of metanotum with two distinct ridges on either side and hind margins broadly polished, apex of metanotum rounded, slightly bulging punctate; propodeum rugosely punctate, equal to metanotum in length, no distinct median carina, lateral carinae strong, apex sinuate, polished; hind coxa finely setigerous punctate upper margin rounded and without spur; hind femur more than 1.5 times as long as wide, evenly punctate on outer surface and with under surface polished and nearly smooth, basal tooth on lower margin largest, second small and inconspicuous, following six teeth increasing, the remaining six decreasing in size, becoming fused. Fore wings fuscous, with purple metallic luster, central area lighter; hind wings subhyaline, clouded apically and along upper margin.

Abdomen longer than head and thorax together; seen from above swollen behind middle, seen from side broadest behind, apex broadly rounded; base with smooth polished truncature and two polished depressions at sides; second tergite 1.2 times as long as wide, punctate except posteriorly below, basal two-thirds reddish, grove of ovipositor deep, smooth, with raised margin and faint longitudinal line in bottom; third and fourth tergites short; fifth less than half sixth; sixth about 0.8 of second, coarsely punctate. Ovipositor reaches nearly to base of abdomen.

Described from two females received from C. F. Baker.

Type.—Cat. No. 24391, U.S.N.M. Type and paratype.

Habitat.—Singapore.

Genus EPEXOCLAENOIDES Girault.

Epexoclaenoides GIRAULT, Mem. Queensland Museum, vol. 14, (1915) pp. 357–358.

Genotype.—*Epexoclaenoides bicinctus* Girault.

Epexoclaenoides recently established by Girault is based on a single Australian species. It differs from the genus *Leucospis* in shape of abdomen and character of teeth on hind femur as shown in key above.

EPEXOCLAENOIDES PYRIFORMIS, new species.

This species agrees with *Epexoclaenoides bicinctus* Girault in having very minute comb-like teeth on under side of the hind femur, short ovipositor, simple metanotum, and hind coxa without a spur on upper margin, but differs from it in size, color, pattern, and probably in structure, although from description given, it is not possible to point our specific differences.

Female.—Length 8.1 mm. *A small black and yellow species with abdomen narrow in front, nearly globular behind, a short ovipositor and minute femoral teeth.*

Body black; tegulae, middle and hind coxa, hind femur beneath, second tergite and ovipositor mostly rufous; following parts pale yellow: scape, transverse bands near front and in hind margins of pronotum, the former slightly wider in median line and dilated at margins, the latter obsolete laterally; short bands on sides of mesoscutum above tegulae; crescent-shaped markings on hind margin of scutellum sometimes interrupted in median line; central part of metapleura; apex of front femur distinctly above, slightly beneath; small spot near apex of middle femur; front and middle tibiae within; conspicuous spot at base of hind coxa on upper margin and spot below near apex; apical two-thirds of upper margin of hind femur widest at apex and a triangular spot on lower margin near base; hind tibia above; tarsi; two transverse bands on abdomen, one covering constricted portion just behind second tergite, narrow in median line much wider laterally, the other near apex, its hind margin touching groove of ovipositor.

Head transverse, as wide as pronotum, face finely rugosely punctate, silvery pubescent; line from median ocellus to level of clypeus about equal to greatest distance between eyes; malar space very short only one-seventh length of eye, cheeks strongly convergent, smooth polished median line on spur, distance across scapal furrow at base nearly three times distance from edge of furrow to eye; vertex broad, rugosely punctate with striated polished areas on either side of lateral ocelli and in front of median ocellus; eyes deeply emarginate; postocellar space two times ocellocular, occipital carina low; antennae 12-segmented, scape about as long as following three segments, first funicular 1.3 times pedicel, third, fourth, and fifth subequal, the rest becoming stouter toward club which is conical (pl. 2, fig. 7).

Pronotum closely punctate, as wide in front as behind, with two transverse carinae parallel to its carinate hind margin, the posterior carina almost complete, the anterior short, obsolete laterally; mesonotum transversely rugosely punctate; mesosternum mostly smooth and polished; scutellum broadly rounded behind; foveae of metanotum parallel ridged with hind margin broadly polished, median area of metanotum punctate, slightly projected, its apex depressed toward middle; propodeum about twice as wide as metanotum, median carina thin, slightly arched, lateral carinae converging behind, spiracular area pubescent. Hind coxa without a distinct spur on upper margin, punctate without, mostly polished within; hind femur (pl. 2, fig. 13) triangular in shape twice as long as wide, outer surface punctate, inner smooth and polished, its lower margin angled midway with apical half very minutely toothed (more than 25 teeth). Wings transparent, veins brown; front wings clouded along postmarginal and at apex.

Abdomen pear-shaped, about as long as thorax, its second tergite narrow giving a petiolate appearance. tergites three to five short, constricted and fused in median line, the remaining tergites swollen and globular in form, the sixth tergite being much the largest and comprising nearly all of the globular portion. A narrow polished median line extends from the triangular depression at base of abdomen backward to nearly the middle of sixth tergite; hypopygium short only about one-half length of abdomen. Ovipositor short and spur-like, longer than abdomen, but not reaching dorsum; its groove just reaches around apex of abdomen. (Abdomen in dorsal and side view shown on pl. 3, fig. 20.)

Male.—Length 5.5 mm. (head missing). Like female in structure and coloration except in following respects: smaller size; abdomen more elongate and more flattened on ventral surface; constricted portion longer; rufous color covers second tergite and extends laterally on sixth; the front yellow transverse band on abdomen is farther behind constricted region than in female, and there is a yellow median spot on apex of abdomen.

Type.—Cat. No. 24392, U.S.N.M. Type female, allotype and three female paratypes.

Habitat.—Type locality.—India: Behar (G. R. Dutt, October, 1907. Pusa Coll. 25). Allotype: Bengal (G. M. C., March, 1908, Pusa Coll. 23). Paratypes from Bengal (G. R. D., October, 1908, Pusa Coll. 22; H. M. L., Nov. 2, 1906, Pusa Coll. 24; R. D. D., Oct. 17, 1908, Pusa Coll. 26).

LIST OF NEW SPECIES OF LEUCOSPIDINAE DESCRIBED SINCE SCHLETTERER'S MONOGRAPH OF 1890.

Epexoclaenoides Girault:
  Epexoclaenoides bicinctus Girault (1915), p. 357, genotype ---- Queensland.
Exochlaenus Shipp:
  Exochlaenus (*Leucospis anthidioides* Westwood). Shipp (1894), p. 245, genotype ---- Brazil.
Exoclaenoides Girault:
  Exoclaenoides uncinctus Girault (1915), p. 356–357, genotype ---- Queensland.
Leucospis Fabricius:
  Leucospis africana Cameron (1907), p. 204 ---- Cape Colony.
  Leucospis bakeri Crawford (1914), p. 457 ---- Philippine Islands.
  Leucospis bicanaliculata Cameron (1910), p. 420 ---- Argentina.
  Leucospis bicincta Viereck (1906), p. 227 ---- Arizona.
  Leucospis denticoxa Strand (1911), p. 97 ---- Argentina.
  Leucospis enderleini Ashmead (1904), p. 405 ---- Brazil.
  Leucospis erythrogastra Cameron (1903), p. 93 ---- Borneo.
  Leucospis feminina Strand, var. of *L. similis* Enderlein 1911). p. 169 ---- New Guinea.
  Leucospis formosofacies Strand (1911), p. 95 ---- Argentina.
  Leucospis formosana Strand, var. of *L. japonica* Walker 1911). p. 98–99 ---- Formosa.
  Leucospis fülleborniana Enderlein (1902), p. 17 ---- Africa.
  Leucospis insularis Kirby (1900), p. 13 ---- Sokotra Islands.
  Leucospis japonica Walker, male described by Ashmead (1904). p. 147 ---- Japan.
  Leucospis kriegeri Enderlein (1901), p. 215 ---- New Guinea.
  Leucospis manaica Roman (1920), p. 5 ---- Brazil.
  Leucospis melanosa Strand, var. of *L. denticoxa* Strand (1911*a*). p. 98 ---- Argentina.
  Leucospis nigerrima Kohl (1908), p. 316 ---- Solomon Islands.
  Leucospis nocticolor Strand (1911), p. 162 ---- New Guinea.
  Leucospis nursei Cameron (1906), p. 92 ---- India.
  Leucospis nyassica Enderlein (1901), p. 219 ---- South East Africa.
  Leucospis obscurascens Strand, var. of *L. hopei* Westwood (1911*a*), p. 99 ---- Chile.
  Leucospis pedata Strand, var. of *L. denticoxa* Strand (1911*a*), p. 98 ---- Argentina.
  Leucospis pulchella Crawford (1914), p. 457 ---- Philippine Islands.
  Leucospis pulchriceps Cameron (1910), p. 419 ---- Argentina.
  Leucospis quettaensis Cameron (1906), p. 91 ---- India.
  Leucospis robertsoni Crawford (1909), p. 51 ---- Florida.
  Leucospis rufitarsis Strand (1911*b*), p. 168 ---- New Guinea.

Leucospis Fabricius—Continued.	
Leucospis schletterери Schulthess-Schindler (1899), p. 250	Portuguese East Africa.
Leucospis simillima Strand (1911*b*), p. 169	New Guinea.
Leucospis similis Enderlein (1901), p. 217	New Guinea.
Leucospis varicollis Cameron (1910), p. 421	Argentina.
Leucospis violaceipennis Strand (1911*b*), p. 169	Mecklenburg.
Leucospis viridissima Enderlein (1912), p. 144	Ceylon.
Micrapion Kriechbaumer:	
Micrapion bilineatum Kriechbaumer (1894), p. 316, genotype	Portuguese East Africa.
Parexoclaenus Girault:	
Parexoclaenus vespoides Girault (1915), p. 355–356, genotype	Queensland.
Polistomorpha Westwood:	
Polistomorpha nigromaculata Cameron (1904), p. 96	Panama.
Polistomorpha nitidiventris Ducke (1906), p. 165	Brazil.

BIBLIOGRAPHY OF LEUCOSPIDINAE (1890–1920).

ASHMEAD, WILLIAM HARRIS:

1899. On the Genera of the Eucharidae. Superfamily VII.—Chalcidoidea. Proc. Ent. Soc. Wash., vol. 4, no. 3, pp. 235–242.

1904*a*. Classification of the Chalcid Flies. Mem. Carneg. Mus., vol. 1, no. 4, pp. I–XI and 225–551. Pittsburgh.

1904*b*. Descriptions of New Hymenoptera from Japan.—II. Journ. New York Ent. Soc., vol. 12, no. 3, pp. 146–165.

BRUES, CHARLES THOMAS:

1918. Parasitic Hymenoptera from the British Soloman Islands, collected by Dr. W. M. Mann. Bull. Mus. Comp. Zool., vol. 53, pp. 97–130.

CAMERON, PETER:

1903. Descriptions of New Genera and Species of Hymenoptera, taken by Mr. Robert Shelford at Sarawak, Borneo. Journ. Strs. Br. Roy. Asiat. Soc., no. 39, pp. 89–181.

1904. Description of a New Genus and Four New Species of Hymenoptera. Trans. Amer. Ent. Soc., vol. 30, pp. 93–96.

1906. On the Tenthredinidae and Parasitic Hymenoptera, collected by Major C. G. Nurse in Baluchistan. Journ. Bombay Nat. Hist. Soc., vol. 17, pp. 89–107.

1907*a*. Description of Species of Parasitic Hymenoptera, chiefly in the collection of the South African Museum, Cape Town. (Second Paper.) Ann. So. Afr. Mus., vol. 5, pp. 203–225.

1907*b*. On the Parasitic Hymenoptera, collected by Major C. G. Nurse in the Bombay Presidency. Journ. Bombay Nat. Hist. Soc., vol. 17, pp. 578–597.

1909. A Contribution to the Knowledge of the Parasitic Hymenoptera of Argentina. Trans. Amer. Ent. Soc., vol. 35, pp. 419–450.

CRAWFORD, J. C.:

1909. New Chalcididae. Proc. Ent. Soc. Wash., vol. 11, pp. 51–52.

1914. New Philippine Hymenoptera. Philippine Journ. Sci., vol. 9, no. 5. Sec. D, pp. 457–464.

DALLA TORRE, C. G. DE:

1898. Cat. Hymen. Chalcididae et Proctotrupidae, vol. 5, pp. 1–598.

DUCKE, A.:

1906. Les especes de Polistomorpha Westwood. Bull. Soc. Ent. France, pp. 163–166.

ENDERLEIN, GÜNTHER:

1901. Neue Evaniiden, Stephaniden, Mutilliden (Apterogyna), Proctotrupiden und Chalcididen mit einer Bestimmungstabelle der afrikanischen Stephaniden. Aus dem Kgl. Zool. Mus. Berl. Archiv. f. Nat. Jahrg. 67, vol. 1, pp. 187–220.

1902. Zur Kenntnis der Insekten Deutsch-Ostafrikas. III. Uber eine von Dr. Fülleborn aus Nyassasee entdeckte neue Leucospidine. Mitteil. Zool. Mus. Berlin, vol. 2, pp. 1–18, 1 pl.

1912. Zur Kenntnis der Chalcididen Ceylons. (Hym.). Ent. Mitteil., vol. 1, no. 5, pp. 144–148.

GIRAULT, ALEXANDER A.:

1915. Australian Hymenoptera Chalcidoidea—XIV. The Family Chalcidae with descriptions of new Genera and Species. (Contrib. no. 37, Ent. Lab. Bur. Sugar Exper. Stat. Bundaberg, Queensland.) Memoirs of the Queensland Mus., vol. 4, pp. 314–365. Brisbane.

GRAENICHER, S.:

1906. On the Habits and Life-History of Leucopis affinis (Say). A Parasite of Bees. Bull. Wisconsin Nat. Hist. Soc., n. s., vol. 4, pp. 153–159, 1 pl.

KIRBY, F. W.:

1900. The Expedition to Sokotra XII. Descriptions of the New Species of Hymenoptera. Bull. Liverpool Mus., vol. 3, pp. 13–24.

KOHL, FRANZ FRIEDRICH:

1907. Zoologische Ergebnisse der Expedition der kaiserlichen Akademie der Wissenschaften nach Südarabien und Sokotra in Jahre 1898–1899. Hymenopteren. Denkschr. Akad. Wiss. Wien, vol. 71, pp. 168–301, 11 pl.

1908 in Rechinger, Karl. Botanische und Zoologische Ergebnisse einer wissenschaftlichen Forschungsreise nach dem Samoa-Inseln, dem Neuguinea– Archipel und Salomons—Inseln. Denkschr. Akad. Wiss. Wien., vol. 81, pp. 306–317, 1 pl.

KRIECHBAUMER, JOS.:

1894. Hymenoptera ichneumonidea a medico nautico Dr. Joh. Brauns in itinere ad oras Africae occidentalis lecta, enumerata et quoad nova descripta. Berl. ent. Zeitschr., vol. 39, pp. 297-318

LICHTENSTEIN, JEAN L.:

1919. Notes biologiques sur les Hymenopteres mediterraneens. Bull. Soc. Ent. France, pp. 147-151.

MASI, LUIGI:

1916. Calcididi del Giglio, I—Toryminae, Leucospidinae, Chaldidinae, Eurytominae. An. Mus. Civ. Storia Nat. Genova, ser. 3, vol. 7, pp. 1–69, pl.

ROMAN, A.:

1920. Wissenschaftliche Ergbnisse der schwedischen entomologischen Reise des Herrn. Dr. A. Roman in Amazonas, 1914–1915. Arkiv. f. Zool., vol. 12, no. 19, pp. 1–30.

SCHLETTERER, AUGUST:

1890. Die Gruppe der Hymenopteren-Gattungen Leucospis Fab., Polistomorpha Westw., und Marres Walk. Berlin Entom. Zeitschr., vol. 35, pp. 141–302, pls. 5 und 6.

SCHMIEDEKNECHT, OTTO:

1909. In Wytsman's Gen. Insect. Hymenoptera. Fam. Chalcididae, pp. 1–550, 8 pl.

SCHULTHESS-SCHINDLER:

1899. La faune entomologique du Delagoa. Hymenopteres. Bull. Soc. Vaud. Sc. Nat., ser. 4, vol. 35, pp. 249–281.

SHIPP, J. W.:

1894a. Exochlaenus, Shipp. A new genus of Leucospidae. Ent. Mo. Mag., ser. 2, vol. 5, p. 245.

1894*b*. Notes on Chalcididae. Entomologist, vol. 27, p. 16.

STRAND, EMBRIK:

1911*a*. Neue und wenig bekannte exotische Arten der Chalcididengattungen Megastigmus Dalm., Merodiomorus Strand (n. g.), Polychromatium D. T. und Leucospis F. Wien. Ent. Zeit. Jahrg. 30, pp. 93–99.

1911*b*. Zur Kenntnis papuanischer und australischer Hymenopteren, insbesondere Schlupfwespen. Intern. Ent. Zeitschr. Guben Jahrg. 5, pp. 86–170.[4]

VIERECK, H. L.:

1906. Notes and Descriptions of Hymenoptera from the Western United States. Trans. Amer. Ent. Soc., vol. 32, pp. 173–247.

---

[4] The actual pages are 86–7, 89–90, 97–8, 103–5, 114, 117–8, 131–2, 150–1, 162–3. 168–70.

EXPLANATION OF PLATES.

PLATE 1.

FIG. 1. General view of body from side (hind leg removed) *L. affinis*, female.
2. Front and hing wing showing veins. *L. affinis*, female.
3. Abdomen dissected to show tergites 1–7 inclusive. *L. affinis*, female.
4. Antenna, showing segmentation. *L. affinis*, male.

PLATE 2.

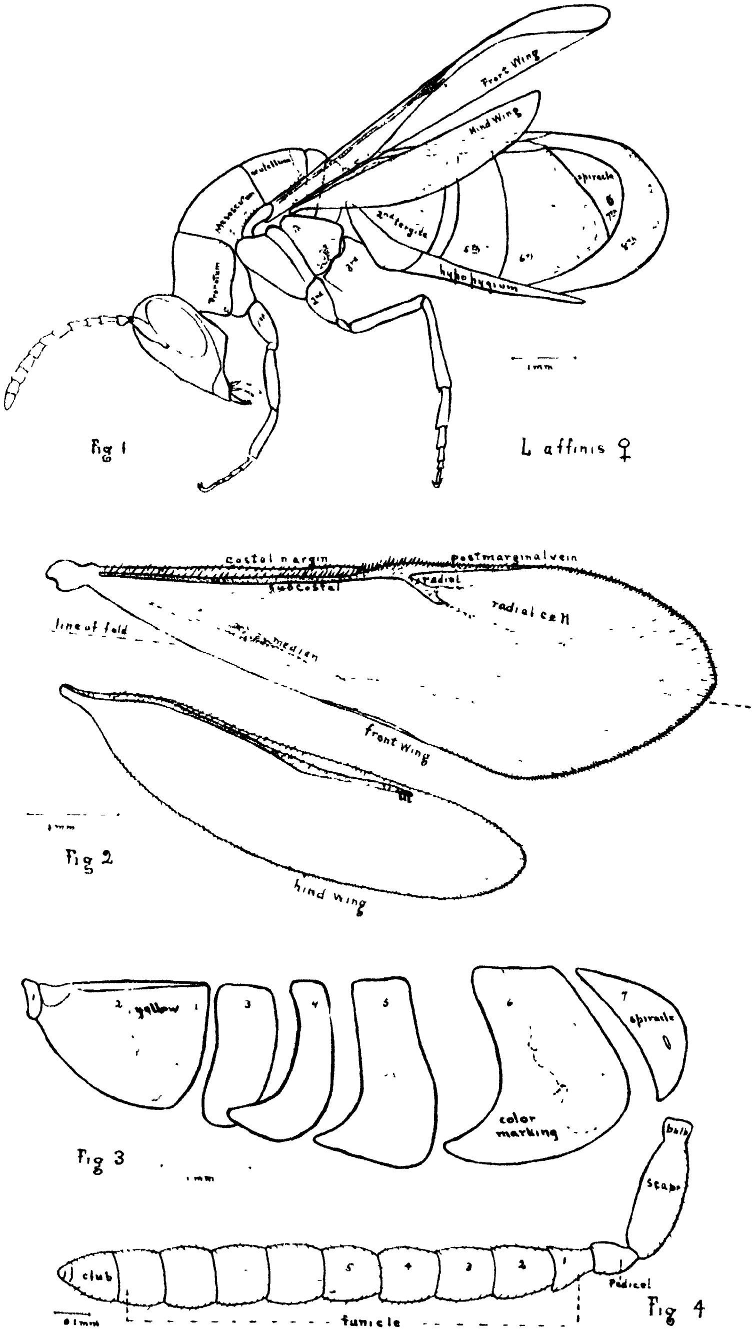
FIG. 5. Head of *Leucospis slossonae* (front view).
6. Head of *Leucospis affinis* (front view).
7. Head of *Epexoclaenoides pyriformis* (front view).
8. Mouthparts of *Leucospis affinis*, from front.
9. Hind femur of *Leucospis opalescens*, from side.
10. Hind femur of *Leucospis slossonae*, from side.
11. Hind femur of *Leucospis fuliginosa*, from side.
12. Hind femur of *Leucospis affinis*, from side.
13. Hind femur of *Epexoclaenoides pyriformis*, from side.

PLATE 3.

FIG. 14. Abdomen in side view of *Leucospis slossonae.*
15. Abdomen in side view of *Leucospis gigas.*
16. Abdomen in side view of *Leucospis dorsigera.*
17. Abdomen in side view of *Leucospis cayennensis.*
18. Abdomen in side view of *Leucospis biguetina.*
19. Abdomen in side view of *Leucospis indiensis.*
20. Abdomen (*a*) in side view and (*b*) from above of *Epexoclaenoides pyriformis.*
21. Abdomen in side view of *Leucospis brevicauda.*

PLATE 4.

FIG. 22. Terminal segments of *Leucospis affinis* with ovipositor and its appendages.
23. Front, middle and hind, tarsi of *Leucospis affinis*, showing tibial spines
24. Hind coxae of *Leucospis cayennensis* and *Leucospis affinis.*
25. Sternal plate of (male) *Leucospis affinis.*
26. Abdomen of (male) *Leucospis affinis* in side view.



LEUCOSPIS AFFINIS.

FOR DESCRIPTION OF PLATE SEE PAGE 41

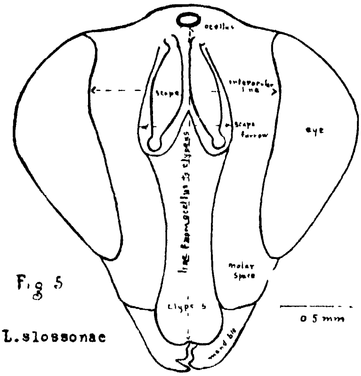


Fig 5

L. slossonae

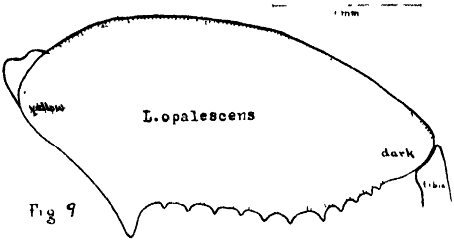


Fig 9

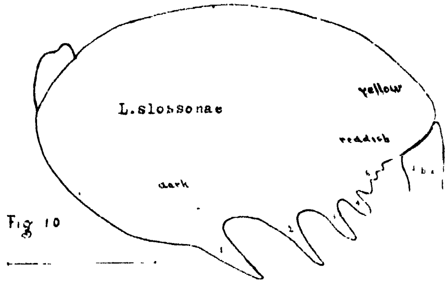


Fig 10

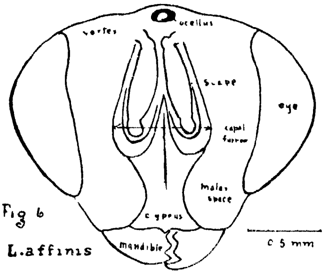


Fig 6

L. affinis

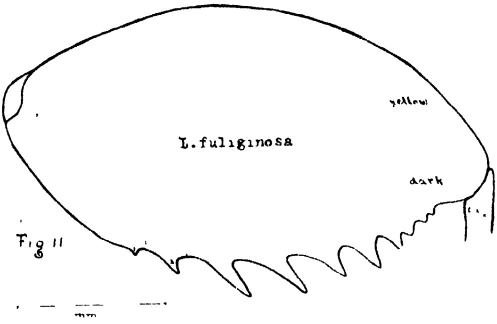


Fig 11

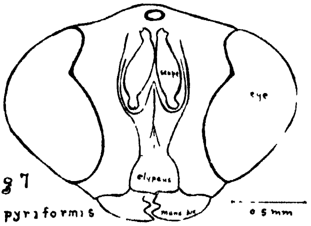
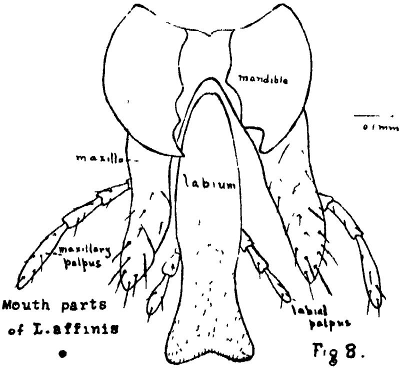


Fig 7

E pyriformis



Mouth parts of L. affinis

Fig 8.

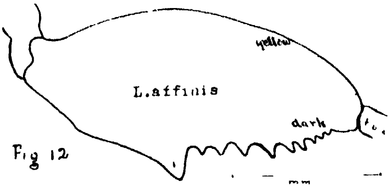


Fig 12

Epexoclaenoides pyriformis

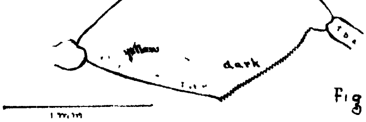
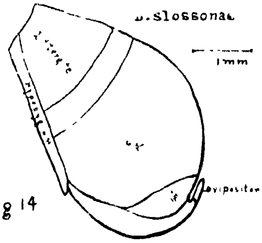


Fig 13

HEADS AND HIND FEMORA OF LEUCOSPIDINAE.

FOR DESCRIPTION OF PLATE SEE PAGE 41.



L. slossonae

Fig 14

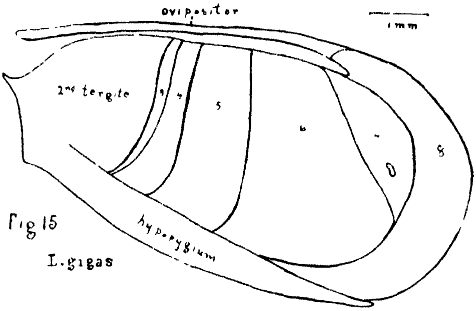
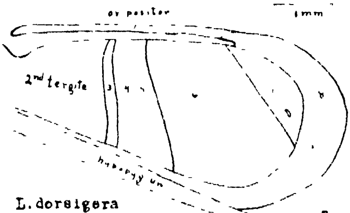


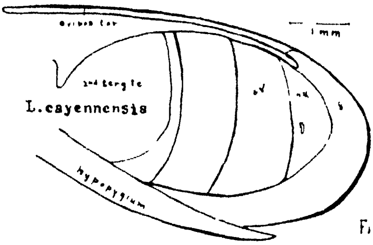
Fig 15

L. gigas



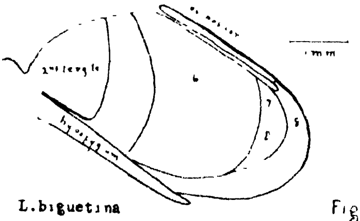
L. dorsigera

Fig 16



L. cayennensis

Fig 17



L. biguetina

Fig 18

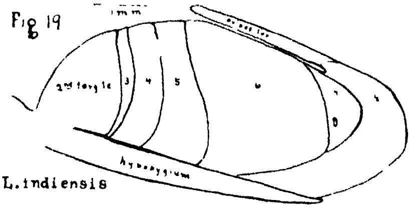
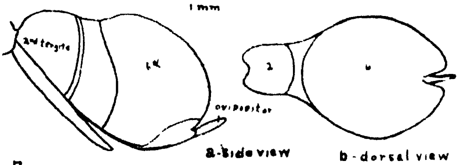


Fig 19

L. indiensis



a-side view b-dorsal view

Fig. 20 Epexoolaenoides pyriformis

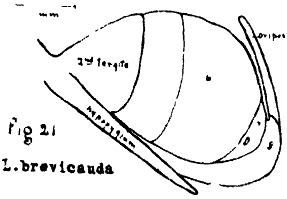


Fig 21

L. brevicauda

ABDOMENS OF LEUCOSPIDINAE.

FOR DESCRIPTION OF PLATE SEE PAGE 41.

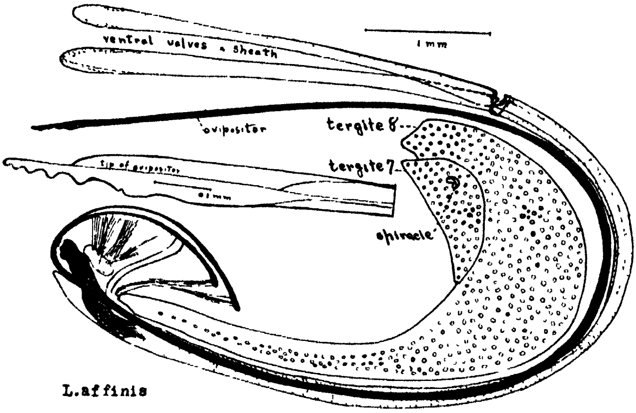


Fig 22

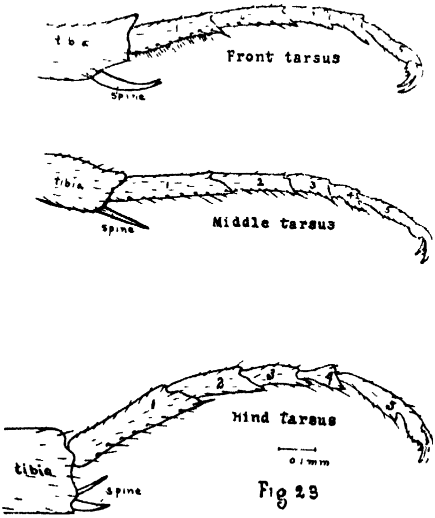


Fig 23

L.affinis

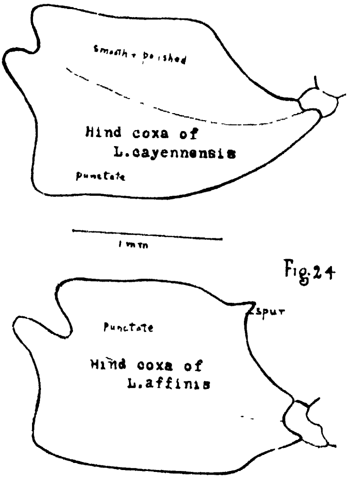
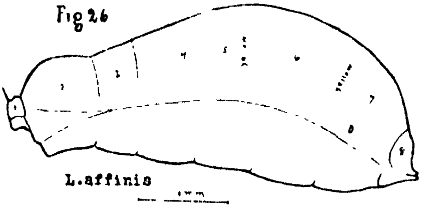


Fig.24

Fig 26



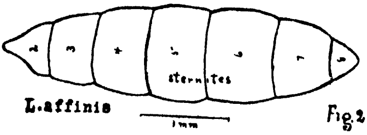


Fig.25

DETAILS OF LEUCOSPIDINAE.

FOR DESCRIPTION OF PLATE SEE PAGE 41

INDEX.

Valid generic names are in bold-face type, specific in Roman, synonyms in italics.

Page.
affinis Say, Leucospis 25
africana Cameron, Leucospis 37
anthidioides Westward, Leucospis 4, 37
apicalis Cresson, Leucospis 28
azteca Cresson, Leucospis 27
bakeri Crawford, Leucospis 30, 37
banksi, new species, Leucospis 21
bengalensis, new species, Leucospis 32
bicanaliculata Cameron, Leucospis 37
bicincta Viereck, Leucospis 27, 37
bicinctus Girault, Epexoclaenoides 35, 37
biguetina Jurine, Leucospis 18
bilineatum (Kriechbaumer), Leucospis 5, 38
brevicauda Fabricius, Leucospis 29
bulbiventris (Cresson) Polistomorpha? 4
cayennensis Westwood, Leucospis 15
decorata, new species, Leucospis 24
denticoxa Strand, Leucospis 37
dicomas Walker, Marres 4
dorsigera Fabricius, Leucospis 4, 32
dubiosa Cresson, Leucospis 27
egaia Walker, Leucospis 18
elegans, new species, Leucospis 17
enderleini Ashmead, Leucospis 37
Epexoclaenoides Girault 35, 37
erythrogastra Cameron, Leucospis 37
Exochlaenus Shipp 4, 37
Exoclaenoides Girault 5, 37
fasciata Westwood, Polistomorpha 4
feminina Strand, var. of Leucospis similis Enderlein 37
floridana Cresson, var. of Leucospis affinis Say 26
formosana Strand, var. of Leucospis japonica Walker 37
formosofacies Strand, Leucospis 37
fuliginosa, new species, Leucospis 18
fülleborniana Enderlein, Leucospis 37
gigas Fabricius, Leucospis 22
guzeratensis Westwood, Leucospis 33
hopei Westwood, Leucospis 28
indiensis, new species, Leucospis 20
insularis Kirby, Leucospis 37
intermedia Illiger, Leucospis 22
japonica Walker, Leucospis 29, 37
kriegeri Enderlein, Leucospis 33, 37
Leucospis Fabricius 4, 37
maculata, new species, Leucospis 30

Page.
manaica Roman, Leucospis 37
Marres Walker 4
melanosa Strand, var. Leucospis denticoxa Strand 37
metallica, new species, Leucospis 13
Micrapion Kriechbaumer 5, 38
nigerrima Kohl, Leucospis 37
nigromaculata Cameron, Polistomorpha 38
nitidiventris Ducke, Polistomorpha 38
nocticolor Strand, Leucospis 37
nursei Cameron, Leucospis 37
nyassica Enderlein, Leucospis 37
obscurascens Strand, var. of Leucospis hopei Westwood 37
opalescens, new species, Leucospis 15
ornatifrons, new species, Leucospis 22
orientalis, new species, Leucospis 28
Parexoclaenus Girault 5, 38
pedata Strand, var. of Leucospis denticoxa Strand 37
poeyi Guérin, var. of Leucospis affinis Say 27
Polistomorpha Westwood 4, 38
pulchella Crawford, Leucospis 22, 37
pulchriceps Cameron, Leucospis 37
pyriformis, new species, Epexoclaenoides 35
quettaensis Cameron, Leucospis 37
robertsoni Crawford, Leucospis 15, 37
robusta, new species, Leucospis 33
rufitarsis Strand, Leucospis 37
schlettereri Schulthess-Schindler, Leucospis 38
simillima Enderlein, Leucospis 38
similis Enderlein, Leucospis 38
slossonae, new species, Leucospis 11
sphegoides Westwood, Polistomorpha 4
sumichrasti Cresson, Leucospis 14
surinamensis Westwood, Polistomorpha 4
texana Cresson, Leucospis 13
tolteca Cresson, Leucospis 15
uncinctus Girault, Leucospis 5, 37
varicollis Cameron, Leucospis 38
vespoides Girault, Leucospis 5, 38
violaceipennis Strand, Leucospis 38
viridissima Enderlein, Leucospis 38

NEW BUPRESTID BEETLES FROM BORNEO AND THE PHILIPPINE ISLANDS.

By W. S. Fisher,

Of the Bureau of Entomology, United States Department of Agriculture.

This paper is based on part of a collection of Buprestidae received from Prof. Charles Fuller Baker, College of Agriculture, University of the Philippines, Los Banos, Philippine Islands, together with the material from that region in the collection of the United States National Museum. The bulk of the material has been collected by Professor Baker, and much credit is due him for his energetic collecting and additions to our knowledge of the insect fauna of these islands. In working over this material, a number of new species and one new genus have been found; these are described in the present paper. The Tribe Agrilini has been treated more fully in a previous paper which has been published in the Philippine Journal of Science.[1]

Through the kindness of Professor Baker, all the types of the new species here described have been placed in the Collection of the United States National Museum.

PHRIXIA ALBOMACULATA, new species.

Male.—Form elongate, subcylindrical, uniformly shining green above with a slight golden reflection; each elytron with seven small round white deciduous pubescent areas arranged as follows: Four on the third interval, the first at the basal fourth, second at middle, third at apical fourth, and a more elongate one a short distance from the apex, also a feebly defined one near the humeral angle and two others on the seventh interval, slightly in advance of the inner ones on the third intervals at middle and apical fourth. Beneath golden green, becoming more cupreous on the prosternum.

Head as wide as pronotum, nearly flat, coarsely and densely punctate, the punctures becoming somewhat elongate on the front, feebly longitudinally grooved on occiput; epistoma not separated from front, deeply depressed and emarginate at middle. Pronotum strongly convex, one-fourth wider than long; sides parallel, without marginal carina except for a short smooth line at posterior angles;

---

[1] Philip. Journ. Sci., vol. 18, 1921, pp. 349–447.

anterior margin nearly straight; posterior margin strongly bisinuate; surface coarsely punctate, the punctures distinct and well separated from each other on the disk, becoming closer and coarser toward the sides and with a well-defined prescutellar fovea, intervals toward lateral margin minutely rugose, smooth on disk. Scutellum small, round; surface smooth. Elytra a little wider than pronotum; sides strongly sinuate at basal third, nearly parallel to apical fourth, then strongly attenuate to apices, which are strongly emarginate and bispinose, the outer spine being the longer; surface rather strongly punctate-striate on disk, the striae and punctures becoming confused toward sides; intervals flat and irregularly punctate. Beneath rather strongly punctate, the puncture distinctly separated from each other, sparsely clothed with rather long, inconspicuous hairs, the intervals vaguely rugose; posterior coxae and base of second, third, and fourth abdominal segments with a white deciduous pubescent spot along lateral margin; last abdominal segment broadly rounded at apex. Femora and tibiae sparsely, coarsely punctuate and vaguely rugose.

Length, 10 mm.; width, 3 mm.

Type locality.—Zamboanga, Mindanao, Philippine Islands.

Type.—Cat. No. 24668, U.S.N.M.

Described from a unique male from Zamboanga, Mindanao, Philippine Islands, collected by Prof. C. F. Baker.

This species is closely allied to *P. vittaticollis* Waterhouse, but can be easily distinguished from that species by the uniformly green color above, and also by each elytron having only seven white pubescent spots.

NEOPTOSIMA PICEA, new species.

Subcylindrical, moderately convex, strongly attenuate posteriorly, of a uniform bright piceous color with a slight purplish tinge; uniformly but not densely clothed with fine, erect cinereous pubescence.

Head strongly and uniformly convex, much narrower than pronotum; surface coarsely and rather densely punctate, the punctures becoming finer on the occiput; epistoma very short, separated from the front by a transverse groove, antennal cavities transverse and limited in front by the epistoma; antennae reaching to middle of pronotum, inserted at the base in a groove between the eyes and prosternum, the groove not prolonged on the latter. Pronotum moderately convex, nearly two times as wide as long, much narrower in front than behind; sides obliquely arcuate; anterior margin bisinuate with a feebly rounded median lobe; base feebly arcuate; disk regularly convex without any depressions, surface densely, regularly, and rather coarsely punctate. Scutellum small, smooth, truncate in front and rounded behind. Elytra at base equal in width to the basal part of pronotum, regularly arcuately attenuate from base to the tips, which are separately rounded; surface striate-punctate, the striae becoming confused toward the lateral margin; intervals flat, with a single row of regularly placed punctures of the same size as those in the striae; pygidium exposed behind the elytra, rounded at apex. Abdomen beneath finely, densely punctate with the apical margin of the segments smooth; first and second segments united; last segment with the lateral margin dentate, apex entire and broadly rounded, and the surface feebly scabrous. Prosternum wide, flat, and broadly rounded behind; anterior margin feebly arcuately emarginate; surface coarsely punctate. Mesosternum narrow, entire, and broadly emarginate in front for the insertion of the prosternal process. Anterior and middle coxae nearly contiguous; posterior coxae feebly dilated in front and behind externally. Legs moderately long; femora subfusiform; tibiae nearly straight, feebly carinated on their outer edge; tarsi short, first joint of posterior tarsi much longer than second; tarsal claws dentate at base; tarsal lamellae pale brown.

Length, 5.75 mm.; width, 2.4 mm.

Type locality.—Dapitan, Mindanao, Philippine Islands.

Type.—Cat. No. 24660, U.S.N.M.

Described from a unique specimen collected by Prof. C. F. Baker, at Dapitan, Mindanao, Philippine Islands. This genus was erected by Mon. A. Théry to include four species found in Madagascar, and Kerremans in his "Monographie des Buprestides, Tome II, p. 536," includes an additional species from the same locality. The above species received from the Philippine Islands fits the original description given for this genus so well that there is little doubt of its belonging to the genus and is the first species of *Neoptosima* found outside of the island of Madagascar. This species is closely allied to *Neoptosima sericea* Kerremans, but differs from it in coloration and the elytra not being wider than the pronotum at base.

CHRYSOCHROA FULMINANS, var. COBALTINA, new variety.

Form and sculpture of *C. fulminans*. Color above of a beautiful shining indigo blue with a strong violaceous tinge, with the apex of the elytra narrowly margined with bright green changing to a reddish coppery color at the extreme tip. Beneath of the same color as above; female with the abdomen greenish posteriorly and with a strong coppery reflection when viewed in certain lights, last segment broadly rounded at apex; male with the three posterior segments of the abdomen of a reddish coppery color and with the apical margin of the last segment broadly angulately emarginate.

Length, female, 40 mm.; male, 28 mm.; width, female, 13 mm.; male, 8.5 mm.

Type locality.—"Tangcolan, Bukidnon."

Type and allotype.—Cat. No. 24674, U.S.N.M.

Described from two specimens, male and female, labeled "Tangcolan, Bukidnon," collected by Prof. C. F. Baker (Baker's No.'s Female 14549, Male 14550).

This beautiful insect resembles *C. fulminans* in form and sculpture but differs from it in the color, which is of a beautiful dark violaceous blue. Doctor Kerremans in his "Monographie des Buprestides, Tome III, p. 102," mentions a blue form under *fulminans* from Java, but does not give it a separate name. As this form is so distinct it seems advisable to give it a new varietal name.

CYALITHOIDES, new genus.

Head wide in front, broadly concave and longitudinally grooved; epistoma short and deeply, arcuately emarginate anteriorly; antennal cavities small, rounded, the upper edge short and elevated. Antennae rather long; first joint elongate, cylindrical, about equal in length to the second and third united; second short, globular; third elongate, cylindrical and narrower than the second; fourth elongate, feebly triangular, and about equal in length to the second and third joints united; joints five to eleven triangular, poriferous on both sides of the joints, longer than wide, gradually becoming shorter anteriorly, the last joint ovate. Eyes large, elliptical, oblique, and slightly closer together on the vertex. Pronotum much wider than long, rather convex without a median longitudinal groove or carina; base sinuate. Scutellum small, transverse, and touching the pronotum. Elytra subparallel, attenuate posteriorly; base feebly lobed; lateral margin serrate posteriorly; surface feebly costate and with discal impressions. Prosternum wide, flat, and rounded at apex; anterior margin truncate. Metasternum feebly, longitudinally grooved. Posterior coxae strongly dilated internally, their anterior margin feebly sinuate and the posterior margin oblique. Legs rather robust; anterior and middle femora fusiform, strongly dilated at middle, posterior femora more cylindrical and flattened on both sides; anterior tibiae feebly arcuate, middle and posterior tibiae slender and straight; tarsi moderately long, the first joint of posterior pair longer than the two following joints united, claws broadly, obsoletely lobed at base.

Genotype.—*Cyalithoides fulgida*, new species.

This genus is closely allied to *Cyalithus* Thomson from Borneo. It differs, however, from that genus in having the head deeply concave in front, elytra with depressed punctured spaces and the different arrangement of the antennal joints.

CYALITHOIDES FULGIDA, new species.

Elongate, subparallel, moderately convex; head green with a golden tinge; pronotum and elytra of a shining reddish coppery color; beneath golden green with a violaceous tinge; legs bluish-green.

Head deeply concave with a rather deep longitudinal groove reaching from the occiput to a deep pit on the front; surface coarsely, irregularly punctate, the punctures denser along the eyes; intervals obsoletely rugose and clothed with a few inconspicuous hairs; antennae reaching to near the posterior angles of pronotum, first three joints greenish, following joints piceous. Pronotum about one and one-half times as wide as long, slightly narrower in front than behind; sides bisinuate and nearly parallel, the posterior angles rather acute; anterior margin rather deeply arcuately emarginate with a broadly rounded median lobe; base bisinuate with the median lobe very broadly rounded, surface with a round shallow depression on each side in front of posterior angles and a similar depression behind them on the base, also a large, deep puncture in front of the scutellum; disk very sparsely and irregularly punctate with a few obsolete punctures intermixed, the punctures becoming denser and much coarser toward the sides, where they become somewhat confused; intervals obsoletely rugose with a few inconspicuous recumbent hairs at the sides. Scutellum smooth, two times as wide as long; anterior margin rounded; posterior margin nearly truncate. Elytra distinctly wider than pronotum at base, rounded at humeral angles. nearly parallel to apical third, then strongly attenuate to the tips. which are conjointly rounded and strongly serrate, the serration extending up the lateral margins for one-third their length; base feebly lobed; each elytron with four indistinct costae interrupted by the depressions, which are arranged as follows: A shallow transverse one along base, a shallow one at the humeral angle, a round shallow one behind the humerus between the third and fourth costae, a large round one slightly behind the post-humeral depression between the first and third costae, and a larger, transversely oblique one just behind the middle and situated between the first and fourth costae; surface finely, sparsely, and irregularly punctate, the punctures becoming denser in the depressed spaces; intervals feebly rugose and obsoletely pubescent. Abdomen beneath sparsely, irregularly punctate, the punctures denser toward the sides and base of segments, sparsely clothed with inconspicuous recumbent hairs; first segment feebly flattened at middle; last segment acutely rounded at apex. Prosternum transversely rugose in front; prosternal process flat, sparsely punctate, with the intervals obsoletely granulated. Legs rather densely punctate, feebly rugose, and sparsely clothed with short cinereous pubescence, the hairs more erect and rigid on the tibiae.

Length, 17 mm; width, 6 mm.

Type locality.—Sandakan, Borneo.

Type.—Cat. No. 24659, U.S.N.M.

Described from a single specimen from Sandakan, Borneo, collected by Prof. C. F. Baker (Baker No. 10357).

This species superficially resembles some of the copper-colored specimens of *Chrysodema smaragdula* Olivier, but can be distinguished from any species of that genus by the absence of the longitudinal carina on disk of pronotum and by its parallel and shorter form.

CHRYSOBOTHRIS GLORIOSA, new species.

Female.—Large and robust, moderately convex, head green, pronotum greenish blue with the posterior angles of a reddish green color, elytra cyaneous, each elytron ornated with four light bluish-green areas; beneath bright green, glabrous.

Head with the front strongly triangular; occiput very narrow, longitudinally carinate, and coarsely, rather densely punctate; vertex coarsely, densely punctate, and strongly projecting over the front, the anterior margin of projection broadly concave; front broadly and deeply concave, the concavity extending beneath the projecting vertex, coarsely concentrically rugose in the concavity, coarsely, densely punctate toward the sides, the punctures becoming confluent along the eyes; eyes large and nearly contiguous on the occiput; epistoma large, broadly, and very deeply, arcuately emarginate in front; antennae greenish, becoming piceous on the serrated joints. Pronotum strongly transverse and moderately convex, about two and one-half times as wide as long, narrower in front than behind when viewed from above, narrowest at the middle; lateral margin strongly sinuate, arcuately rounded anteriorly and posteriorly to the middle, which is arcuately concave, anterior angles bent downward; posterior angles rather acute; anterior margin nearly truncate; posterior margin very deeply bisinuate with a large median lobe feebly arcuately concave in front of scutellum; surface coarsely and deeply punctate and somewhat transversely rugose toward posterior angles, the punctures widely separated on the disk, becoming coarser and denser toward the sides; a very vague depression on each side in front of elytral lobe. Scutellum large, very acutely pointed posteriorly; surface smooth. Elytra distinctly wider than the pronotum at base, rounded at humeral angles, then gradually arcuately attenuate to the tips, which terminate in a short spine; lateral margin coarsely serrate to near the humeral angles; base strongly lobed; surface without striae, coarsely and deeply punctate, the punctures widely separated on the disk, becoming coarser and denser on the greenish depressed areas and along lateral margin, each elytron ornated with light bluish green areas, as follows: A short narrow band along suture behind the scutellum, a longitudinal area on humeral callus, a longitudinal area behind the anterior lobe extending into a deep depression near base, a transverse oval depressed spot on disk at middle, and a round depressed one at apical third, situated a little closer to the lateral margin than the suture. Abdomen beneath coarsely and rather densely punctate, the punctures widely separated on the median part, the surface becoming strongly longitudinally rugose along lateral margin; posterior margin of segments smooth; last segment arcuately emarginate at apex, with a strongly elevated longitudinal carina at middle. Prosternum coarsely transversely rugose, and rather strongly gibbose a little distance behind the anterior margin. Femora robust, anterior femora with a long, acute tooth on the outer edge at apical third.

Length, 19 mm.; width, 9 mm.

Type locality.—Iligan, Mindanao, Philippine Islands.

Type.—Cat. No. 24669, U.S.N.M.

Described from a single female from Iligan, Mindanao, Philippine Islands, collected by Prof. C. F. Baker (Baker No. 11979). This species is closely allied to *C. cyanipennis* Deyrolle, described from Amboine. It differs, however, from that species in having the head broadly concave in front and not longitudinally impressed, and epistoma deeply emarginate, the elytra not green at base, and also by having each elytron marked with four greenish spots instead of three, as in *cyanipennis*.

BELIONOTA OBSCURIPENNIS, new species.

Female.—Form robust, uniformly dark slate color above, feebly cupreous on pronotum, with the head and sides of pronotum, fiery red. Beneath dark greenish-blue with a strong violaceous reflection, sides of prosternum and posterior four abdominal segments with a fiery red spot on each side at the base; femora and tibiae greenish-blue, the anterior femora cupreous on the inner side.

Head with the front triangular, feebly convex, coarsely and sparsely punctate, the punctures becoming denser and more confluent along the margin of the eyes, strongly, transversely strigose on the anterior half; inner margin of antennal cavities feebly elevated; occiput feebly, longitudinally carinate; vertex with a deep elongate depression at middle; epistoma very feebly concave along anterior margin. Pronotum feebly convex, nearly two times as wide as long, distinctly narrower in front than behind; sides nearly parallel to middle, then obliquely narrowed to anterior angles; posterior angles acute and protruding; anterior margin arcuately emarginate; posterior margin deeply bisinuate, the median lobe truncate in front of scutellum; surface rather coarsely and sparsely punctate on the disk; the punctures becoming denser and somewhat confluent along lateral margin, with a deep lunate depression on each side, the bottom of which is sparsely strigose. Scutellum triangular, elongate, about one-fourth as long as elytra, the apex very acute; finely, irregularly, and sparsely punctate over entire surface. Elytra feebly convex, distinctly wider than pronotum at base, and about two and one-half times as long, broadly rounded at humeral angles; sides feebly narrowed to apical third, then more strongly attenuate to the apex, which is broadly rounded, with a short tooth at the sutural angle, lateral margin smooth, without serration posteriorly; surface finely and rather densely punctate, the punctures becoming denser along lateral margin; each elytron with two smooth, very feebly elevated costae, the first extending from base to apex and parallel to the suture, the second parallel to the lateral margin, beginning behind the humerus and joining the margin near apex, there are also two smooth intermediate costae which are not elevated and nearly obsolete. Prosternum gibbose along anterior margin, rather densely and finely punctate, the punctures becoming nearly obsolete posteriorly. Abdomen feebly longitudinally depressed at middle, becoming broadly grooved on last segment; surface densely and rather coarsely punctate at middle, becoming coarsely, longitudinally strigose toward lateral margin; suture between first and second segments acutely angulate at middle; last segment feebly emarginate at tip, on each side of which is a deep emargination, the lateral tooth long and very acute. Femora coarsely, irregularly strigose.

Length, 24 mm.; width, 9.5 mm.

Type locality.—Butuan, Mindanao, Philippine Islands.

Type.—Cat. No. 24673, U.S.N.M.

Described from a single female from Butuan, Mindanao, Philippine Islands, collected by Prof. C. F. Baker (Baker No. 14558). This is closely allied to *B. prasina* Thunberg and *B. fallaciosa* Deyrolle. From the former it differs by having the pronotum less densely punctate and the sides more broadly margined with a fiery red color, elytra smoother, head fiery red, underside dark greenish-blue with red spots on the side of each abdominal segment, abdomen feebly grooved at middle, with the apex more feebly emarginate. From *B. fallaciosa* Deyrolle it differs by having the scutellum punctate; pronotum with the sides more reddish and the posterior angles protruding, head fiery red, and the abdomen feebly grooved at middle. This species is also closely allied to *B. mindorensis* described by Kerremans from Mindoro, but, according to his description, that species has the underside entirely black, and abdomen widely grooved at the middle.

BELIONOTA RUBRIVENTRIS, new species.

Female.—Form robust, uniformly dark aeneous above, the pronotum and scutellum slightly more cupereous with the posterior angles of the former fiery red. Beneath with the median parts fiery red, forming triangular areas at the base of the last three abdominal segments, the area becoming less distinct on the last segment and divided into two small acute triangular spots on the lateral margin of the median groove; sides of prosternum and abdominal segments broadly aeneous with a violaceous reflection, becoming steel-blue along apical margin of the abdominal segments; femora and tibiae aeneous, the latter becoming greenish toward the apex.

Head with the front triangular, feebly convex, very coarsely and rather closely punctate, the punctures becoming confluent anteriorly, and finer and more closely placed along the margin of the eyes where the surface is also sparsely clothed with a series of rather long recumbent hairs; inner margin of antennal cavities strongly elevated; occiput longitudinally carinate; vertex with a moderately deep, broad depression at the middle; epistoma feebly bisinuate along anterior margin, the median tooth feebly developed. Pronotum feebly convex, nearly two times as wide as long, distinctly narrower in front than behind; sides nearly parallel to middle, then obliquely narrowed to anterior angles; posterior angles rectangular and not protruding; anterior margin arcuately emarginate; posterior margin bisinuate, the median lobe feebly emarginate in front of scutellum; surface coarsely and rather densely punctate, the punctures becoming coarser and confluent along lateral margin, with a broad oblique depression on each side, the bottom of which is strongly strigose. Scutellum triangular, elongate, about one-fifth as long as elytra, the apex very acute; surface smooth without trace of punctures. Elytra feebly convex, distinctly wider than pronotum at base, and more than three times as long, broadly rounded at humeral angles; sides parallel to middle, then strongly attenuate to the apex, which is acutely rounded, with a sharp tooth at the sutural angle, lateral margin smooth, without serration posteriorly; surface coarsely and densely punctate, the punctures becoming denser and somewhat confluent along the lateral margin; each elytron with four smooth, feebly elevated costae, as follows: The first parallel to suture and extending from base to apex; second very arcuate, extending from behind humerus to apical third; third sinuate and reaching from behind the humerus near lateral margin to the apical sixth; and the fourth parallel to the lateral margin beginning near the middle and joining it near the apex. Prosternum flat along anterior margin, coarsely and sparsely punctate, the punctures becoming transversely elongate along front margin. Abdomen broadly and deeply grooved at middle; surface coarsely and rather densely punctate at middle, becoming strigose laterally, the striae denser and more longitudinal along the lateral margin; suture between first and second segments nearly straight at middle; last segment deeply, arcuately emarginate at tip, obliquely broadening on each side to the lateral tooth, which is quite small. Femora coarsely, irregularly strigose.

Length, 27 mm.; width, 9.5 mm.

Type locality.—Sandakan, Borneo.

Type.—Cat. No. 24672, U.S.N.M.

Described from a single female from Sandakan, Borneo, collected by Prof. C. F. Baker (Baker No. 14560). This species is closely allied to *B. prasina* Thunberg and *B. fallaciosa* Deyrolle. From the former it differs by having the scutellum without any trace of punctures, pronotum more coarsely punctate and the underside fiery red along the middle. From *B. fallaciosa* it differs by having the pronotum more densely punctate, prosternum flat along front margin, suture between first and second abdominal segments not acutely angulate at middle, underside fiery red along middle, and the last abdominal segment without lateral depressions and more rectangularly emarginate at tip.

PHILANTHAXIA OBSCURA, new species.

Oblong-oval, head, pronotum and elytra of a uniform dull, blackish bronze color, glabrous; beneath more shining bronzy than above and sparsely clothed with fine, recumbent, cinerous pubescence.

Head flattened, broadly depressed on vertex; surface densely, strongly reticulate, the reticulation forming a network of small, irregular sunken areas; eyes large, prominent, extending slightly beyond the pronotum on either side; epistoma wide, anterior margin broadly arcuately emarginate. Pronotum convex nearly two times as wide as long, distinctly narrower in front than behind; sides strongly arcuate and feebly sinuate near the posterior angles, which are produced and acute; anterior margin arcuately emarginate with a feebly rounded median lobe; base truncate; surface with a slight impression on each side near posterior angles, punctation similar to that on the head, the reticulation becoming transverse on the disk near the scutellum. Scutellum broadly triangular, nearly two times as wide as long, truncate in front; surface finely granulated and feebly concave. Elytra about equal in width to the pronotum at base; sides strongly sinuate behind the humeri, and nearly parallel to the apical third, then obliquely attentuate to the tips, which are separately narrowly rounded; lateral margin finely serrate; each elytron with a transverse depression situated a little before the base and becoming deeper externally; humeri prominent; surface deeply and regularly striate, the striae not quite reaching to the apex and becoming obsolete at the scutellar region and toward the lateral margin; intervals flat, densely, transversely rugose, rather densely, finely punctate, and becoming finely scabrous at the apex. Abdomen beneath densely and rather coarsely ocellate-punctate, becoming somewhat longitudinally rugose on the last segment, which is broadly rounded at apex; posterior coxae with the posterior margin deeply concave externally; prosternum and middle of body strongly and densely scabrous; femora and tibiae finely but not densely rugose.

Length, 7 mm.; width, 3.25 mm.

Type locality.—Davao, Mindanao, Philippine Islands.

Type.—Cat. No. 24664, U.S.N.M.

Described from a single specimen collected by Prof. C. F. Baker (Baker No. 8318) at Davao, Mindanao, Philippine Islands.

PHILANTHAXIA ELONGATA, new species.

Oblong, more elongate than either *Philanthaxia obscura* or *P. cyanescens*, head, pronotum and elytra of a uniform dark-reddish, coppery color with a slight violaceous tinge, glabrous; beneath dark bronzy and very sparsely clothed with short, recumbent, cinereous pubescence.

Head flattened, surface densely, strongly reticulate, the reticulation forming a network of small, irregular sunken areas; eyes large, prominent, extending slightly beyond the pronotum on either side; epistoma wide, anterior margin broadly, arcuately emarginate. Pronotum convex, nearly two times as wide as long, slightly narrower in front than behind; sides feebly arcuate and strongly sinuate near posterior angles, which are produced and acute; anterior margin arcuately emarginate, with the median lobe broadly rounded; base truncate; surface with an obsolete depression on each side near posterior angles, punctation similar to that on the head. Scutellum subcordiform, truncate in front, wider than long; surface finely granulated and feebly concave. Elytra slightly wider than pronotum at base; sides sinuate behind the humeri and feebly diverging to the apical third, then obliquely attenuate to the tips, which are separately, narrowly rounded; lateral margin finely serrate; each elytron with a transverse depression situated a little below the base and becoming deeper externally; surface deeply and regularly striate, the striae not quite reaching to the apex and becoming somewhat confused at the scutellar region; intervals flat, densely, transversely rugose, rather densely finely punctate, and becoming finely scabrous at the apex. Abdomen beneath densely and coarsely ocellate-punctate, becoming longitudinally rugose on the last segment, which is rather broadly rounded at apex; posterior coxae with the posterior margin deeply concave externally; prosternum and middle of body roughly and densely scabrous; femora and tibiae finely but not densely rugose.

Length, 8.5 mm.; width, 3.5 mm.

Type locality.—Davao, Mindanao, Philippine Islands.

Type.—Cat. No. 24665, U.S.N.M.

Described from a single specimen collected by Prof. C. F. Baker (Baker No. 8349) at Davao, Mindanao, Philippine Islands.

PHILANTHAXIA CYANESCENS, new species.

Oblong-oval, head pronotum and elytra uniformly cyaneous with a slight violaceous tinge, glabrous; beneath piceous with a slight greenish tinge and sparsely clothed with fine, recumbent, cinereous pubescence.

Head strongly convex, transversely concave between the antennae; surface densely, strongly reticulate, the reticulation forming a network of small, irregular, sunken areas; eyes not projecting beyond the pronotum on either side; epistoma wide, truncate in front. Pronotum convex, nearly two times as wide as long, slightly narrower in front than behind; sides feebly arcuate and sinuate near posterior angles, which are rather obtuse; anterior margin arcuately emarginate with a feebly rounded median lobe; base truncate; surface with a very feeble broad impression on each side near posterior angles, punctuation similar to that on the head, but becoming finer on the disk. Scutellum cordiform, truncate in front, wider than long; surface finely granulated and strongly concave. Elytra slightly wider than pronotum at base; sides sinuate behind the humeri and feebly diverging to the apical third, then obliquely attenuate to the tips, which are separately, narrowly rounded; lateral margin finely serrate; each elytron with a deep transverse groove situated a little below the base at the outer margin, the space between the base and groove being raised and rounded; humeri prominent; surface deeply and regularly striate, the striae not quite reaching to the apex and somewhat confused at the scutellar region; intervals flat, densely, transversely rugose, rather densely, finely punctate, and becoming scabrous at the apex. Abdomen beneath finely and rather densely ocellate-punctate, becoming somewhat longitudinally rugose on the last segment, which is rather acutely rounded at apex; posterior coxae with the posterior margin truncate; prosternum and middle of body strongly and densely scabrous; femora and tibiae finely but not densely rugose.

Length, 7.5 mm.; width, 3.5 mm.

Type locality.—Philippine Islands, without definite locality.

Type.—Cat. No. 24666, U.S.N.M.

Described from a unique specimen in the United States National Museum collection labeled "Acc. No. 905, Bur. Agri., P. I., collected by C. R. Jones," without any definite locality given.

ANTHAXIA ATTENUATA, new species.

Elongate, strongly attenuate posteriorly, shining blackish olivaceous, with the head, front and sides of pronotum, and a narrow band along base of elytra of a bright green color, beneath piceous with a strong brassy tinge, sparsely clothed with inconspicuous recumbent cinereous hairs; legs greenish.

Head small, not as wide as pronotum at anterior margin; front flat and feebly concave, the distance between the eyes equal to about two times the diameter of the eye when viewed from the front; surface densely and coarsely ocellate-punctate; eyes small and not projecting; epistoma small with the anterior margin broadly arcuately emarginate. Pronotum transverse, about one and one-half times as wide as long, front and base about equal in width, widest at middle; lateral margin strongly, regularly arcuate; anterior margin deeply, arcuately emarginate with scarcely any median lobe; base truncate; surface with a broad, shallow depression in front of posterior angles, densely and coarsely ocellate-punctate, similar to that of the head but not quite as deeply impressed. Scutellum ogival in shape, base truncate, feebly convex and finely punctate. Elytra about equal in width to the pronotum at base, strongly attenuate to the tips, which are separately, narrowly rounded, not covering the sides of abdomen which is broadly visible from above, moderately convex; each elytron with a deep transverse groove situated a little distance below the base, a narrow, very deep one between the humerus and lateral margin, a broad, obsolete one behind the humerus and a similar one at basal third along suture; humeri rather prominent; surface finely, very densely rugose and sparsely clothed with very short, inconspicuous cinereous pubescence. Abdomen beneath finely ocellate-punctate; last segment broadly rounded at apex. Prosternum finely ocellate-punctate; prosternal process rather wide and flat.

Length, 3.9 mm.; width, 1.5 mm.

Type locality.—Cuernos Mountains, Negros, Philippine Islands.

Type.—Cat. No. 24667, U.S.N.M.

Described from a single specimen collected by Prof. C. F. Baker (Baker No. 8348) in the Cuernos Mountains, Negros, Philippine Islands.

ANTHAXIA MINDANAOENSIS, new species.

Elongate, nearly parallel, dull, piceous with a strong bronzy tinge; posterior angles of pronotum of a reddish coppery color, a narrow green band at base on inner half of elytra and a similar band behind scutellum, extending along suture for about one-sixth the distance to apex, glabrous; beneath black with a feeble bronzy tinge and very sparsely clothed with inconspicuous cinereous hairs; anterior tarsi bluish green.

Head large, as wide as pronotum at anterior margin; front feebly convex, the distance between the eyes equal to about four times the diameter of the eye when viewed from the front; surface densely and rather coarsely ocellate-punctate; eyes large and projecting; epistoma small, with the anterior margin broadly, arcuately emarginate. Pronotum fully two times as wide as long, front and base about equal in width, widest at middle; lateral margin strongly, regularly arcuate; anterior margin deeply, arcuately emarginate, with a broadly rounded median lobe; base truncate; surface with a broad, shallow depression in front of posterior angles, densely and rather coarsely ocellate-punctate, similar to that of the head. Scutellum triangular, flat, and finely rugose. Elytra a little wider than pronotum at base, parallel to apical third, then arcuately attenuate to the tips, which are separately, narrowly rounded, moderately convex; each elytron with a deep transverse groove situated a little distance below the base, a short deep one between the humerus and lateral margin and a broad shallow one behind the humerus; humeri rather prominent; surface very finely rugose, the rugae becoming nearly obsolete posteriorly. Abdomen beneath obsoletely ocellate-punctuate; last segment feebly truncate at apex. Prosternum coarsely ocellate-punctate; prosternal process narrow, and longitudinally gibbose, with the surface finely, densely scabrous.

Length, 3.6 mm.; width, 1.5 mm.

Type locality.—Davao, Mindanao, Philippine Islands.

Type.—Cat. No. 24671, U.S.N.M.

Described from a single specimen collected by Prof. C. F. Baker (Baker No. 8332) at Davao, Mindanao, Philippine Islands.

CORAEBUS CYANEOVIRIDIS, new species.

Short, moderately convex, uniformly brilliant bluish-green; beneath shining black with a strong aeneous tinge, prosternum greenish.

Head not produced in front beyond the eyes, widely and rather deeply longitudinally grooved from the vertex to epistoma, feebly punctate-rugose and sparsely clothed with inconspicuous black pubescence, the hairs becoming whitish and more conspicuous along the apical margin; epistoma large, anterior margin broadly, and deeply arcuately emarginate, strongly constricted at middle by the insertion of the antennae, deeply transversely grooved in front of clypeal suture, which is slightly elevated on each side. Pronotum much wider than long, front and base about equal in width, widest at the apical third; disk convex and regularly rounded, with the sides narrowly depressed from apical angles to base; lateral margin finely crenulate, strongly arcuate to apical third, then feebly narrowed to the posterior angles, which are nearly rectangular; anterior margin arcuately emarginate, with the median lobe feebly angulate at middle; base strongly bisinuate with a broadly rounded median lobe in front of scutellum; surface rather finely punctate and feebly rugose, sparsely clothed with inconspicuous black hairs, becoming cinerous near the apical angles; lateral carina not present. Scutellum cordate, very feebly rugose. Elytra about equal in width to the pronotum, slightly convex, each elytron with a deep depression at the base, a similar one along the lateral margin behind humerus, and a broad, shallow one along suture near apex; sides slightly sinuate and nearly parallel to the apical third, then arcuately attenuate to tips, which are conjointly broadly rounded; lateral margin finely crenulate anteriorly, becoming strongly serrate toward apex; surface strongly imbricate, sparsely clothed with short black, curved hairs, which are scarcely visible, except when viewed from the side. Beneath coarsely imbricate and sparsely clothed with short recumbent cinereous hairs.

Length, 7 mm.; width, 2.75 mm.

Type locality.—Baguio, Luzon, Philippine Islands.

Type.—Cat. No. 24670, U.S.N.M.

Described from a single specimen collected by Prof. C. F. Baker, on oak (*Quercus*, species) at Haight's Place, in the mountains above Baguio, Luzon, Philippine Islands, at an altitude of 8,000 feet. This species is closely allied to *Coraebus melibaeiformis* Saunders and *Coraebus azureus* Fisher. From both these species it differs by not having a lateral carina on the pronotum. It can also be distinguished from the former by being more elongate and of a bluish-green color and from the latter by the absence of pubescent markings on the elytra.

SAMBUS PHILIPPINUS, new species.

Large, rather robust and moderately convex, head and pronotum brilliant green, elytra bronzy and marked with irregular bands of cinereous pubescence on apical part; beneath bronzy, and sparsely clothed with short white pubescence.

Head with front slightly rounded, narrowly, longitudinally grooved, the groove becoming obsolete on the front; surface finely and rather densely punctate, feebly rugose and sparsely clothed with short. recumbent cinereous pubescence; antennae bronzy, not quite reaching to middle of pronotum; clypeal suture distinct; epistoma rather wide, transverse between the antennae. Pronotum two times as wide as long, slightly narrower in front than behind, widest at the middle;

sides narrowly flattened and regularly arcuate, with the margin feebly crenulate; anterior margin bisinuate, with the median lobe broadly rounded; base strongly bisinuate, with the median lobe broadly rounded in front of scutellum; lateral carina arcuate, reaching from posterior angle to apical third, but not touching the lateral margin; disk strongly convex anteriorly, with a rather deep depression on the inside of the lateral carina, becoming broader posteriorly and reaching along the base; surface rather densely punctate, finely reticulate and sparsely clothed with short inconspicuous black and cinereous pubescence. Scutellum large, triangular, dark green; surface finely reticulate. Elytra at base about equal in width to pronotum at middle, rather convex, with a shallow depression at base and another along lateral margin behind the humerus; sides feebly sinuate and nearly parallel to middle, expanded at apical third, then arcuately attenuate to the tips, which are separately rounded and finely dentate; surface rather coarsely imbricate, sparsely clothed with inconspicuous recumbent black hairs and each elytron marked with a series of sparsely placed, short white hairs, as follows: A distinct transverse zigzag band at apical fourth, a narrower transverse one near the apex, joining the anterior one along the suture. Abdomen finely reticulate, last segment deeply arcuately grooved along the apical margin.

Length, 6.25 mm.; width, 2.5 mm.

Type locality.—Kolambugar, Mindanao, Philippine Islands.

Type.—Cat. No. 24663, U.S.N.M.

Described from a unique specimen collected by Prof. C. F. Baker. at Kolambugar, Mindanao, Philippine Islands.

This species is allied to *Sambus ornatus* Fisher and *Sambus confusus* Fisher, but it can, however, be distinguished at once from either of these species by its larger size and by the absence of distinct cinereous pubescence on the anterior half of the elytra.

NEOSAMBUS CYANEUS, new species.

Elongate, robust, and strongly convex, shining; head blue, becoming brassy on the front; pronotum and elytra bright blue; scutellum brassy; beneath shining black, with a bluish tinge, becoming more pronounced toward the sides, glabrous except for a few scattered hairs on prosternum and last abdominal segment.

Head with the front wide, strongly convex, feebly gibbose on the vertex, with a feeble longitudinal median groove on vertex and occiput, becoming obsolete on middle of front; surface strongly strigose, the strigae transverse on the front and becoming concentrical on the gibbosities; intervals with moderately large, shallow punctures; epistoma transverse, anterior margin broadly, but not deeply, arcuately emarginate, the angles extending beneath the antennal cavities; clypeal suture transverse, and feebly elevated. Pronotum one and one-half times as wide as long, widest at about the middle, slightly narrower in front than behind; sides feebly margined and crenulate, strongly arcuate from apex to basal sixth, then nearly straight to the posterior angles, which are nearly rectangular; anterior margin deeply emarginate, with a large, broadly rounded lobe at middle, the angles acute; base strongly bisinuate with a large median lobe, which is truncate in front of the scutellum; disk strongly gibbose behind the middle; surface with a broad, irregular depression along the lateral margin, extending from apical sixth to base, then transversely to the scutellum, coarsely, transversely rugose, except on the gibbosity, where the rugae are more or less concentrical; intervals smooth with elongate punctures connected posteriorly to the rugae. Scutellum triangular, very acute posteriorly; surface obsoletely rugose. Elytra as wide as pronotum at base, strongly convex; humeral angles obtusely angulate; sides strongly sinuate at posterior coxae, broadly expanded just behind the middle, then arcuately narrowed to tips, which are separately broadly rounded, and finely dentate; surface very coarsely, transversely rugose, becoming much smoother toward apex, intervals with coarse elongate punctures behind the rugae. Abdomen rather convex, glabrous except for a few scattered hairs on the tip of the last segment, surface sparsely punctate and feebly marked with crenulate lines, last segment feebly emarginate at apex and broadly concave at middle; prosternum coarsely scabrous and sparsely pubescent; prosternal process nearly parallel to behind coxae, then abruptly narrowed to apex, which is acute and bent downward; tarsi and claws black; tarsal lamellae brownish.

Length, 5.75 mm.; width, 2.25 mm.

Type locality.—Mount Banahao, Luzon, Philippine Islands.

Type.—Cat. No. 24661, U.S.N.M.

Described from a single specimen from Mount Banahao, Luzon, Philippine Islands. collected by Prof. C. F. Baker. This species is closely allied to *Neosambus cupricollis* Fisher, but differs from it in the coloration of the head and pronotum.

TOXOSCELUS ACUTIPENNIS, new species.

Large, rather robust and moderately convex, head and pronotum dull bronzy, with a slight purplish tinge, elytra bronzy with irregular black and purplish markings; beneath of a brighter bronze color than above.

Head convex, feebly gibbose on each side of the occiput, with a deep longitudinal groove extending from the occiput into a rather deep, round impression on the vertex, the groove becoming obsolete on the front; surface strongly rugose, the rugae becoming somewhat concentrical on the gibbosities, intervals finely granulated;

antennae short, reaching a little beyond the apical angles of pronotum, serrate from the fifth joint; epistoma narrow between the antennae, a narrow, deep groove behind the antennae, extending longitudinally down the epistoma to near the anterior margin, which is narrow and arcuately rounded; cheeks unarmed; antennal cavities large and situated a certain distance from the inner margin of the eyes; eyes rather large, oval, and feebly oblique. Pronotum two times as wide as long, wider in front than behind, widest at the apical third; sides broadly rounded in front to apical third, then converging rapidly in nearly a straight line to the posterior angles, which are broadly rounded; anterior margin arcuately emarginate with a large, broadly rounded median lobe; base strongly bisinuate with a large median lobe feebly concave in front of scutellum; lateral carina short, parallel to sides, and reaching from apical fourth to just behind the middle; surface concentrically rugose, the intervals finely granulated, with a narrow depression between the lateral carina and lateral margin, two round depressions on each side at about the middle, the outer one near the anterior part of the lateral carina, and the inner and deeper one slightly behind the outer one and near the median part, there is also a large, shallow depression in front of the scutellum. Scutellum large, triangular, and acute at apex; surface finely granulated. Elytra much wider than pronotum at base, rather flat, with a shallow depression on each side at base; sides sinuate, nearly parallel anteriorly, feebly expanded behind the middle to partially cover the widely expanded abdomen, then rapidly converging to the tips, which are acuminate and finely dentate at sides; surface strongly rugose anteriorly, becoming finely granulated with a few short rugae intermixed toward the apex, marked with irregular bronze, black, and purplish designs, and with a large, conspicuous, irregular black area along the suture at apical third, this area is smooth, sparsely and finely punctate, and surrounded by a bronze zigzag band. Abdomen densely marked with finely crenulate lines and sparsely clothed with short white hairs; last abdominal segment with three short knifelike projections at the apex; prosternum broadly, arcuately emarginate in front.

Length, 7.5 mm.; width, 2.6 mm.

Type locality.—Baguio, Luzon, Philippine Islands.

Type.—Cat. No. 24662, U.S.N.M.

Described from a single specimen collected by Prof. C. F. Baker (Baker No. 16423) on oak (*Quercus*, species) at Haight's Place, in the mountains above Baguio, Luzon, Philippine Islands, at an altitude of 8,000 feet. This specimen is not a typical *Toxoscelus* but is placed temporarily in this genus. It differs from the typical species of this genus by having the front margin of the epistoma rounded and the tips of the elytra acuminate.

ON THE ASHMEAD MANUSCRIPT SPECIES OF ICHNEUMONIDAE OF MRS. SLOSSON'S MOUNT WASHINGTON LISTS.

By R. A. Cushman.

Of the Bureau of Entomology, United States Department of Agriculture.

Through the medium of several lists of insects from the Alpine region of Mount Washington, New Hampshire, compiled by Mrs. Annie Trumbull Slosson and published in the Entomological News during 1894–1906, Ashmead proposed a considerable number of manuscript names of Hymenoptera. Among these are 57 Ichneumonidae besides one which Ashmead called "Pimplinae n. gen. et n. sp." Some of these are indicated by "Ashm. MS.," others by "Ashm., n. sp.," while some names appear that have never been published elsewhere, although not indicated as new or manuscript species. Of the 58 species I have been able to locate all but four, mostly in the National Museum collection, but some among specimens sent me by Mrs. Slosson. All of the 54 identified species are now in the National Collection. Many of these specimens do not bear Ashmead's name labels. Some of these latter can be connected with the names by means of number labels corresponding to manuscript lists of the 1902 and 1906 material. The other lists are not numbered. Other specimens evidently from the same source lack both name and number labels and can never be associated with any names that Ashmead may have applied to them.

I am able to make this paper much more nearly complete than would otherwise be possible through the kindness of Mrs. Slosson, who has sent me for the United States National Museum files all of the letters from Ashmead referring to the Mount Washington Hymenoptera and also some of the specimens for which I had looked in vain in the National Collection. I take this opportunity to express my thanks to Mrs. Slosson.

Following is a list of Mrs. Slosson's papers on the insects of Mount Washington:

1. Entomological News, vol. 5, Jan., 1894, pp. 1–6.
2. Entomological News, vol. 6, Jan., 1895, pp. 4–7.
3. Entomological News, vol. 7, Dec., 1895, pp. 316–321.

No. 2429—Proceedings U. S. Medical Museum, Vol. 61, Art. 8.

4. Entomological News, vol. 7, Nov., 1896, pp. 262–265.
5. Entomological News, vol. 8, Dec., 1897, pp. 237–240.
6. Entomological News, vol. 9, Dec., 1898, pp. 251–253.
7. Entomological News, vol. 11, Jan., 1900, pp. 319–323.
8. Entomological News, vol. 13, Jan., 1902, pp. 5–8.
9. Entomological News, vol. 13, Dec., 1902, pp. 319–321.
10. Entomological News, vol. 17, Nov., 1906, pp. 323–326.

Ashmead's manuscript species of Ichneumonidae occur only in Nos. 3, 4, 5, 7, 8, 9, and 10.

Since the publication of these lists some few of the species have been described by other specialists, while some of the other names are based on specimens of already described species.

In the following pages the manuscript names are listed in alphabetical order by genera with indication of the disposition made of each. In case a species is synonymized with a described species in another genus or is described as new in another genus it appears again in its proper order with the Ashmead manuscript name given in the synonymy.

A few species not known to occur on Mount Washington are discussed in order to clear up confusion caused by the association of these names in literature with species that were taken on Mount Washington, while a few others are included to indicate generic transfers. Such species are indicated by an asterisk (*).

***ABSYRTUS PANISCOIDES (Ashmead).**

Perilissus paniscoides ASHMEAD, Trans. Amer. Ent. Soc., vol. 23, 1896, p. 187 (excluding male).

Eczetesis paniscoides (Ashmead) DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 253.

This species is not known to occur on Mount Washington and is inserted here in order to indicate the proper position of both parts of Ashmead's composite species. The female, having been described first in the original description of *paniscoides*, is hereby selected as the holotype. The male described by Ashmead is that of *Parabetes monticola* Cushman, new species, described on another page of this paper. It was synonymized by Davis (reference as above) with *Paniscus albotarsatus Provancher.* In this, however, Davis was in error, *albotarsatus* being an *Alexter.* (See *Alexeter albotarsatus* [Provancher].)

ADELOGNATHUS AMERICANUS, new species.

"*Trachyporthus americanus* Ashm. n. s.," SLOSSON, Ent. News, vol. 5, 1897, p. 237.

Runs in Roman's key to European species[1] to *marginellus* Holmgren, agrees perfectly with descriptions of that species, and may prove to be synonymous with it. For the present, however, since European specimens are not available for comparison, it seems better to maintain it as a distinct species.

---

[1] Ent. Tidskr., 1918, p. 12.

Female.—Head opaque, vertex polished; temples as broad as eyes; diameter of lateral ocellus barely half as long as postocellar line, which is slightly longer than ocell-ocular line; clypeus distinctly separated, about half as long as interfoveal line, broadly truncate at apex; labrum exserted, truncate; malar space nearly as long as basal width of mandible. Thorax subopaque above, polished laterally, propodeum also polished; notauli distinct anteriorly; prepectal carina lacking; propodeum declivous from base; radius before middle of stigma; areolet open with no trace of second intercubitus; nervulus interstitial; base of second discoidal cell much longer than apex of brachial. Abdomen polished; first tergite as broad as long, flat above, without carinae; tergites 2–5 with base and apex medially weakly chitinized; ovipositor concealed.

Black; inner orbits, face above, clypeus laterally, and mandibles yellow; face below, broader at sides, dark brown; clypeus medially paler brown; antennae black; scape brown below; palpi pale brown; tegulae, wing bases, humeral angle of pronotum, front and middle coxae at apex, and their trochanters whitish; coxae otherwise and basal joint of hind trochanter black; femora testaceous, hind femur piceous; tibiae and tarsi, especially hind ones, fuscous, front and middle tibiae paler at extremities; wings hyaline; abdomen black with weakly chitinized portions pale.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25007, U.S.N.M.

One female taken by Mrs. Annie T. Slosson.

ADELOGNATHUS PERSIMILIS, new name.

Catalytus pallipes ASHMEAD, Proc. U. S. Nat. Mus., vol. 12, 1890, p. 419.
"*Pammacra pallipes* Ashm." SLOSSON, Ent. News, vol. 13, 1902, p. 6.

Ashmead seems not to have understood the genus *Adelognathus*, for the only species he referred to it was *texanus* Ashmead, described in the same paper as *Catalytus pallipes*. *Adelognathus texanus* is the genotype of the genus *Lethades* Davis.

Ashmead's types of *pallipes* run in Roman's key[2] to *pallipes* (Gravenhorst) and agree perfectly with the description of that species, but because of lack of European specimens for comparison it seems best to maintain it as distinct.

The specific name *pallipes* being preoccupied in *Adelognathus* by *pallipes* (Gravenhorst) it is necessary to rename *pallipes* (Ashmead.)

Type.—Cat. No. 3047, U.S.N.M.

---

[2] Ent. Tidskr., 1918, p. 12.

(ADIOSTOLA [sic!] TESTACEIPES Ashmead MS.)=LYMEON? TESTACEIPES Cushman, new species.

***ALEXETER ALBOTARSATUS (Provancher).**

Paniscus albotarsatus PROVANCHER, Nat. Can., vol. 6, 1874, p. 106, male and female; Nat. Can., vol. 11, 1879, p. 146, male and female; Faune Ent. Can. Hym., 1883, p. 361, male and female, and p. 785, female.

The type of this species has been examined by Mr. A. B. Gahan, and a specimen compared by him with the type is in the National Museum collection. This is an *Alexeter*. Mr. Gahan was of the opinion that two of the three females assigned to this species by Provancher were not the same species as the type male, while the other might be. Provancher's statement that the ovipositor is longer than the thickness of the abdomen would seem to indicate that the female described is not an Alexeter. As to what these females are Mr. Gahan makes no statement in his notes.

This species is not known from Mount Washington, but is discussed here because it is involved in the confusion in relation to *Parabatus monticola* Cushman, new species, described on a later page of this paper.

ALEXETER RIPARIUS (Davis).

Mesoleptus riparius DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 315.
"*Hadrodactylus affinis* Ashm., n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 6.

At my request Mr. S. A. Rohwer has, during a recent visit to Philadelphia, compared the type of Ashmead's manuscript name with that of *riparius* Davis and pronounces them the same.

If the right wing of the type of Ashmead's name is used in running it through Davis's key to the Mesoleptini it will run to *Alexeter*, but it is none of the species placed there by Davis. The left wing, having the areolet incomplete, runs it to *Mesoleptus*, where Davis placed his species. Ashmead's type differs from that of *riparius* by having the mesopleurum very largely and the propodeum and metapleurum entirely black. Two males from Georgetown, District of Columbia, and Rosslyn, Virginia, lack the areolet and conform more closely in color to the description, though one has the hind femora red instead of black.

The distinct glymmae place the species in *Alexeter*.

(AMEROLYTUS [sic!] FLAVIFRONS Ashmead MS.)=EXOCHUS ALPINUS Cushman, new species.

APERILETUS CLYPEATUS, new species.

"*Aperileptus clypeatus* Ashm., n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 6.

No specimens from Mount Washington have been found, but one so labeled by Ashmead from Franconia, New Hampshire, is the basis of the following description.

I have not seen the types of Davis's two species, but doubt very much if they belong to *Aperileptus;* the shagreened body and highly ornamented head and thorax are foreign to the genus.

Female.—Length, 3 mm.; antennae, 3.5 mm.; ovipositor, 1 mm.

Head fully half as thick antero-posteriorly as wide; temples rather broad; diameter of lateral ocellus hardly as long as post-ocellar line; eyes convergent below; clypeus strongly rounded at apex; thorax entirely polished; propodeum entirely without carinae, even the pleural carinae lacking; areolet much longer than wide; abdomen compressed from base of third tergite; ovipositor sheath only about as long as first three tergites.

Piceous black; pronotum pale, especially the margins; clypeus, mandibles, cheeks immediately at base of mandibles, scape and pedicel beneath, tegulae, and legs largely stramineous; palpi and wing bases white; hind tibiae and tarsi somewhat infuscated; wings hyaline, venation brown; abdomen piceous, second tergite in basal middle whitish.

Type locality.—Franconia, New Hampshire.

Type.—Cat. No. 25008, U.S.N.M.

One specimen.

APERILEPTUS DELICATUS, new species.

"*Proedrus delicatus* Ashm., n. sp.," SLOSSON, Ent News, vol. 8, 1897, p. 237.

Closely allied to *clypeatus* Cushman and differing principally as follows:

Female.—Length, 3 mm.; antennae, 3.5 mm.; ovipositor, 1.5 mm.

Head distinctly less than half as thick antero-posteriorly as wide, temples sharply receding; diameter of posterior ocellus fully as long as postocellar line; eyes parallel within; clypeus truncate at apex; areolet but little longer than wide; ovipositor sheath fully as long as abdomen.

Color as in *clypeatus* Cushman.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25009, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

(APERILAPTUS [sic!] PARVUS Ashmead MS.)=PLECTISCUS PARVUS Cushman, new species.

(APERILEPTUS PLEURALIS Ashmead MS.)=MEGASTYLUS ASHMEADI Cushman, new species.

(ASYNCRITA COMPRESSA Ashmead MS.)=ATRACTODES ASHMEADI Cushman, new species.

ATMETUS PECTORALIS Ashmead MS.

"*Atmetus pectoralis* Ashm., n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

A unique male.

ATRACTODES ASHMEADI, new species.

"*Asyncrita compressa* Ashm.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.

Differs from *Asyncrita* Foerster in not having the second tergite compressed nor the postpetiole polished and in having the postpetiole much wider than the petiole.

Female.—Length, 5.75 mm.; antennae, 3 mm.

Head half as thick antero-posteriorly as broad, broad behind eyes, temples strongly convex, polished; face opaque rugulose-punctate, medially elevated, scarcely half as long as wide; eyes parallel; clypeus less than half as long as broad, deeply separated at sides, hardly separated in middle, coarsely and sparsely punctate, medially slightly, roundly protuberant; malar space scarcely as long as basal width of mandible; antennae slender, basal joint of flagellum three times as long as thick, others gradually shorter to subapical ones, which are barely longer than thick; mesoscutum subpolished, finely coriaceous medially, sparsely punctate laterally, notauli distinct anteriorly; scutellum polished, sparsely punctate; pronotum laterally and mesopleurum obliquely striato-coriaceous; metapleurum and propodeum finely coriaceous, latter more or less rugulosely so, median apical area reaching very nearly to base, wider at base than at apex and slightly concave; areolet small, second intercubitus largely bullated but distinct, recurrent before middle; abdomen about a third longer than head and thorax; first tergite subopaque coriaceous, postpetiole twice as wide as petiole, medially concave; abdomen otherwise polished; second tergite with epipleural fold extending to apex; compression of abdomen beginning behind base of second tergite.

Black; scape and clypeus dark rufous, mandibles paler; tegulae testaceous; legs beyond coxae dull rufo-testaceous, hind tibia slightly and all tarsi fuscous; wings hyaline, venation dark brownish; abdomen beyond first tergite piceous.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25010, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

Ashmead's name for this species is not employed because it was previously used by Cresson for *Stilpnus compressus*, which is also an *Atractodes*.

***ATRACTODES COMPRESSUS (Cresson).**

Stilpnus compressus CRESSON, Proc. Ent. Soc. Phila., vol. 10, 1865, p. 260.

Not known from Mount Washington, but included here to indicate its proper generic position.

ATRACTODES GRANDIS, new species.

"*Exolytus grandis* Ashm.," SLOSSON, Ent. News, vol. 11, 1900, p. 320.

Will not run to *Exolytus* in Ashmead's key because of the compressed abdomen.

Female.—Length, 9 mm.; antennae (broken).

Temples narrower than eyes, strongly convex, polished; face opaque and densely punctate medially; eyes divergent below; malar space slightly longer than basal width of mandible; clypeus separated from face, about half as long as broad, medially slightly produced at apex, opaque punctate basally; basal joint of flagellum more than three times as long as thick (others missing); mesoscutum, scutellum, and mesopleurum above polished, practically impunctate, notauli distinct anteriorly; pronotum laterally rugulose; mesopleurum below subopaque punctate, sternauli transversely striate; metapleurum and propodeum irregularly rugulose, basal areas polished, median area shining shagreened, not reaching base, of equal width at base and apex, wider in middle, scarcely concave; areolet small, entirely open at apex, recurrent before middle; abdomen nearly twice as long as head and thorax; first tergite shagreened, dorsally faintly longitudinally striate, postpetiole hardly twice as wide as petiole, medially sulcate; abdomen otherwise polished; second tergite with epipleural fold extending slightly beyond spiracle.

Black; mandibles, antennae at base, tegulae, legs largely, and abdomen from second to fourth tergites more or less red, hind coxae and femora piceous; wings hyaline, venation blackish.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25011, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

ATRACTODES SERPEDONTUS, new species.

"*Altractodes serpedontes* Ashm.," SLOSSON, Ent. News, vol. 13. 1902, p. 6.

At once distinguishable in the female from *compressus* (Cresson) by the entire lack of the epipleural fold on the second tergite, which in *compressus* extends to about the middle of the tergite. From *ashmeadi* Cushman it differs in the lack of the epipleural fold and in color of abdomen.

Female.—Length, 6 mm.; antennae, 3.5 mm.

Head behind eyes broad but not as broad as the eyes, polished; face minutely and rather densely punctate, subopaque; eyes divergent below; malar space narrower than basal width of mandible; clypeus less than half as long as broad, basally coarsely punctate, apically polished, distinctly separated medially; first joint of flagellum more than three times as long as thick at apex and distinctly longer than second; mesoscutum and scutellum polished, notauli distinct anteriorly; pronotum laterally indistinctly sculptured; mesopleurum polished; metapleurum and propodeum irregularly transversely rugulose, basal areas smooth, median area not reaching base, strongly narrowed toward base, weakly concave; areolet large, incomplete, the second intercubitus entirely absent, recurrent in middle; abdomen about a third longer than head and thorax; first tergite polished, not concave medially; rest of abdomen highly polished; second tergite without epipleural fold; the abdomen compressed from base of second tergite.

Black, with mandibles, apex of clypeus, scape and pedicel, tegulae, humeral angles of pronotum, legs and second and third tergites red, tarsi infuscated; wings hyaline, venation blackish.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25012, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

(ATROMETUS FLAVIFRONS Ashmead MS.)=LABRORYCHUS CHLAMIDATUM (Provancher).

BANCHUS PALLESCENS Provancher.

Banchus pallescens PROVANCHER, Nat. Can., vol. 6, 1874, p. 62; Faune Ent. Can., Hym., 1883, p. 391.

Banchus insignis PROVANCHER, Nat. Can., vol. 6, 1874, p. 63; Faune Ent. Can., Hym., 1883, p. 391.

"*Corynephanes tarsalis* Ashm., MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 321.

The synonymy of *insignis* with *pallescens* is on the strength of a note by Mr. A. B. Gahan, who has seen the types of both species.

BARYCNEMIS SLOSSONAE, new species.

"*Barycnemis slossonae* Ashm., n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

Very closely allied to *linearis* Ashmead, the only other North American species that has been referred to the genus, but differing in its larger size, shorter and stouter antennae, darker venation, and shorter, stouter, and more strongly curved ovipositor.

Female.—Length, 5 mm.; antennae, 3 mm.

Head polished, face and vertex very sparsely and weakly punctured; temples receding, weakly convex; vertex impressed behind ocelli; diameter of lateral ocellus half as long as postocellar line; eyes fully a half longer than wide; malar space slightly shorter than basal width of mandible; face and clypeus each as long as broad; basal joint of flagellum twice as long as apical thickness, the subapical joints little longer than thick; thorax from above tapering slightly posteriorly, from the side of nearly uniform depth and two and a half times as long as deep, propodeum very long, precipitate behind, its dorsal face nearly twice as long as the posterior face; pronotum foveolate in impression, polished before and punctate behind; mesoscutum very finely shagreened and sparsely, finely punctured, notauli distinct anteriorly and meeting in a broad densely shagreened impression; scutellum polished above, opaque laterally; mesopleurum with a deep longitudinal, foveolate groove, above which it is polished with the anterior upper angle punctate, mesopleural furrow foveolate; mesolcus foveolate, the sternum polished; mesopleurum opaque striato-punctate; propodeum with a subfoveolate median groove extending from base to top of declivity where it is limited by the obsolete apical carina, subopaque above, polished laterally and sparsely punctate; hind tibia two-thirds as long as femur, basitarsus nearly as long as femur; obdomen polished, nearly a half longer than head and thorax; first tergite curved; medially longitudinally impressed, lateral fovea distinct, elongate, postpetiole less than twice as long as petiole, obscurely longitudinally striate, as is also the second tergite in middle; ovipositor stout, curved in nearly a quarter circle, sheath as long as first tergite.

Black; abdomen piceous red, the tergites paler apically and laterally, first black; mandibles, clypeus, scape and pedicel, tegulae, and all coxae piceous, hind coxae nearly black; legs otherwise testaceous; wings hyaline, venation nearly black.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25013, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

(BATHYMETIS SLOSSONAE Ashmead MS.)=PHYGADEUON SLOSSONAE Cushman, new species.

BATHYMETIS TEGULARIS Ashmead MS.

"*Bathymetis tegularis* n. sp., Ashm.," SLOSSON, Ent. News, vol. 11, 1900, p. 319.

Only abdomen and one wing left.

BATHYMETIS WASHINGTONENSIS Ashmead MS.

"*Bathymetis washingtonensis* Ashm.," SLOSSON, Ent. News, vol 17, 1906, p. 324.

Was retained by Ashmead but not found in National Museum collection.

CAMPOPLEX NOLAE (Ashmead).

Limneria nolae ASHMEAD, Proc. U. S. Nat. Mus, vol. 12, p. 431.
"*Limneria notae* Ashm.," SLOSSON, Ent. News, vol. 7, 1895, p. 317.
Omorgus nolae CUSHMAN, Proc. Ent. Soc. Wash., vol. 17, 1915, p. 137.

CHAERETYMMA VELOX (Cresson).

Cryptus velox CRESSON, Proc. Ent. Soc. Phila., vol. 3, 1864, p. 293. •
Cryptus quebecensis PROVANCHER, Nat. Can., vol. 6, 1874, p. 179.
"*Isotina tibialis* Ashm.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.

The above synonymy is on the strength of notes by Mr. Rohwer, who has recently compared Ashmead's type with that of Cresson.

Immediately distinguishable from *minuta* Cushman by the entirely black hind tibia and tarsus, this color also embracing the apex of the femur.

COLPOMERIA KINCAIDII (Ashmead).

Zaglyptus kincaidii ASHMEAD, Ins. Life, vol. 6, 1894, p. 260.

"*Polysphincta albocoxalis* Ashm. MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 320.

Colpomeria kincaidii CUSHMAN, Proc. U. S. Nat. Mus., vol. 58, 1920, p. 20.

(CORYNEPHANES TARSALIS Ashmead MS.)=BANCHUS PALLESCENS Provancher.

COSMOCOMUS (sic.) AMERICANUS Ashmead MS.

"*Cosmocomus americanus* Ashm. MS.," SLOSSON, Ent. News, vol. 11, 1900, p. 320.

Retained by Ashmead but not found in National Museum collection.

CREMASTUS LONGIGENALIS Cushman.

" *Temelucha scutellata* Ashm. MS.," SLOSSON, Ent. News, vol. 11, 1900, p. 320.

Cremastus longigenalis CUSHMAN, Proc. U. S. Nat. Mus., vol. 53, 1917, p. 516.

(CTENACME MONTICOLA Ashmead MS.)=PARABATES MONTICOLA Cushman, new species.

CYMODUSA COXALIS, new species.

"*Phaedroctonus coxalis* Ashm. MS.," SLOSSON, Ent. News, vol. 11, 1900, p. 319.

The distinctly converging eyes place this species in *Cymodusa* in spite of the lack of the areolet. In Ashmead's key[3] to the species of *Limneria* it runs to *rufipes* Provancher, but will not run to that species in Provancher's key,[4] nor does it appear to be any of the species included in either of these keys.

Female.—Length, 5 mm. Face two-thirds as broad as vertex, together with clypeus much longer than broad; temples convex, sloping; thorax granulated, pronotum laterally and mesopleurum above striate; median areas of propodeum shallowly concave and transversely striate; areolet wanting; second abscissa of cubitus only about half as long as intercubitus; lower angle of discoidal cell acute; nervellus obsoletely broken near bottom; abdomen rather slender; second tergite nearly as long as first, spiracles beyond middle; ovipositor slightly longer than first tergite, slightly upcurved.

Black; mandibles, palpi, tegulae, front and middle trochanters, and apical joint of hind trochanter white; antennae blackish, the scape beneath concolorous; legs testaceous, hind femur and tibia at base and apex and their tarsi fuscous, the tibia pale in the middle;

---

[3] Proc. U. S. Nat. Mus., vol. 12, 1890, p. 428.

[4] Faun. Ent. Can., 1883, p. 365.

all coxae and basal joint of hind trochanter black; wings hyaline, venation brown.

Type locality.—Mount Washington, New Hampshire.

Type.—Cat. No. 25014, U.S.N.M.

One female from Mrs. Slosson.

DELETER WASHINGTONENSIS Ashmead MS.

"*Deleter washingtonensis* Ashm. n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

Retained by Ashmead but not found in National Collection.

DELOMERISTA TEXANA (Cresson).

Pimpla texana CRESSON, Trans. Amer. Ent. Soc., vol. 3, 1870, p. 145.

"Pimpline n. gen. et n. sp., Ashmead," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

(DIATORA COMPRESSA Ashmead MS.)=POLYAULON COMPRESSUM Cushman, new species.

DIOCTES ALTICOLA, new species.

"*Zaporus alticola* Ashm. n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

Can not run to *Zaporus*, as placed by Ashmead, for the head is strongly transverse with receding temples, not cubical.

Female.—Length 5.5 mm.; antennae, 4 mm.

Very similar to *obliteratus* (Cresson) but more slender, the thorax being nearly twice as long as high, and with the propodeal carinae, except basal, indistinct.

Head and thorax silvery pubescent; head narrow, scarcely as wide as thorax; temples sloping; face as broad as vertex, frons slightly wider due to slight emargination of eyes; malar space as long as basal width of mandible; antennae very slender. Thorax granulated; propodeal carinae behind basal weak and diffused, areola apparently separated from petiolar area; legs slender, hind tibia distinctly smaller near apex than near base; stigma very narrow; second abscissa of cubitus longer than intercubitus; lower apical angle of discoidal cell acute, the recurrent nearly continuous with second abscissa of cubitus; second abscissa of discoidens shorter than third; spiracles of second tergite at middle; gastrocoeli removed from base, connected by a transverse furrow; ovipositor sheath hardly as long as first tergite.

Black, this color including the hind coxae and basal joint of trochanters; mandibles, palpi, scape and pedicel below, tegulae, front and middle coxae and trochanters, apical joint of hind trochanter, hind tibia largely, calcaria, and bases of tarsal joints whitish; legs testaceous, the hind tibia at base and apex and the tarsal joints at apex fuscous; wings hyaline with venation brown, white at base.

Type locality.—Mount Washington, New Hampshire.

Type.—Cat. No. 25015, U.S.N.M.

One female from Mrs. Annie T. Slosson.

(EPHIALTOMORPHA SLOSSONAE Ashmead MS.)=POLYSPHINCTA ELONGATA Cushman.

Ashmead's type is also the type and only known specimen of *elongata.*

(EPITOMUS AMERICANUS Ashmead MS.)=PLESIGNATHUS AMERICANUS Cushman, new species.

(ERIGLOEA LONGITARSIS Ashmead MS.)=XENOSCHESIS SLOSSONAE Cushman.

EUCEROS ALBOMARGINATUS, new species.

"*Scorpiorus albomarginatus* Ashm. MS.," Slosson, Ent. News, vol. 13, 1902, p. 320.

Very distinct in its largely black body with propodeum, metapleura and base of first tergite ferruginous and tergites white-margined.

Female.—Length, 11 mm.; antennae, 10 mm.

Stout; face, frons and cheeks densely punctate, clypeus, vertex behind ocelli, and temples sparsely so, space between eyes and ocelli polished; clypeus less than half as long as wide, apically narrowly rounded and elevated; malar space as long as basal width of mandible; cheeks and temples rather weakly buccate, the latter with a transverse furrow originating at the occipital carina and extending about half the width of the temples; antennal scrobes deep and sharply margined laterally; inner orbits tumid opposite antennae; antennae less strongly compressed than usual. Thorax shining, but rather densely punctate; scutellum sloping nearly from base, polished, sparsely punctate; propodeum short, very steeply declivous behind, deeply impressed in basal middle, posterior face much longer than dorsal, carinae very high, petiolar area with a median carina. Abdomen broad; first tergite broader than long, anterior basin very broad and short, median carinae prominent for a short distance beyond, the space between elevated; tergites 1–6 with a transverse subapical impression, 2–4 scarcely half as long as wide.

Black; mandibles narrowly pale at base of teeth; palpi pale brownish; antennae brown above, reddish beneath; a minute spot in posterior orbits white; tegulae white at base, brown at apex; mesothoracic spiracle and a minute spot on each side of prescutum, apex of scutellum and postscutellum white; propodeum, metapleura, and metasternum together with the base of the first tergite ferruginous; abdomen otherwise black with tergites 1–6 each with a median transverse white mark as apex broadest in middle and occupying about half the width of the tergite; wings hyaline, venation piceous, base of stigma and costa yellowish; legs testaceous except hind tibia and tarsus, which are black, the tibia white at base.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25016, U.S.N.M.

One female from Mrs. Annie T. Slosson.

EUCEROS COUPERI Cresson.

Euceros couperi CRESSON, Can. Ent., vol. 1, 1869, p. 104.
Euceros couperi DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 255.
"*Scorpiorus flavopictus* Ashm., n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 6.

EXOCHUS ALPINUS, new species.

"*Amerolytus flavifrons* Ashm.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

Very closely related to *evectus* Cresson, differing as follows:

Male.—Length, 4 mm.; antennae, 3 mm.

Face shining, sparsely punctured; mesoscutum practically impunctate; scutellum distinctly, though slightly, convex; first tergite slightly wider at apex than long; second a little more than half as long as wide at apex; third and fourth fully twice as wide as long; tergites 1 to 4 strongly punctate at least at base, the first polished medially; scape, pedicel, and few basal joints of flagellum yellow; scutellum and postscutellum not yellow at apex; legs stramineous; hind coxae at extreme base more or less blackish; hind femur in middle and tibia at apex pale testaceous.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25017, U.S.N.M.

Two males from Mrs. Annie T. Slosson.

EXOCHUS MANDIBULARIS, new species.

"*Polyclistus frontalis* Ashm., MS," SLOSSON, Ent. News, vol. 13, 1902, p. 321.

Chiefly remarkable for the swollen and basally constricted mandibles, the thin, flat, and apically strongly rounded clypeus, and very short antennae. It differs from *alpinus* as described above as follows:

Male.—Length, 6mm.; antennae, 3 mm.

Face more densely punctured; clypeus flat, thin, polished with very sparse punctures, strongly rounded, almost angulate in middle at apex: mandibles swollen in middle, constricted at apex; antennae only slightly more than half as long as body; mesoscutum sparsely though distinctly punctured, especially laterally; scutellum flat; first tergite much longer than wide at apex; second quadrate; third and fourth only slightly wider than long; tergites polished, at most with minute and sparse punctures; flagellum not pale below at base; scutellum yellow apically and laterally; postscutellum narrowly yellowish; upper angle of prepectus with a yellow spot; hind coxa and femur testaceous, the latter whitish at apex, the tibia narrowly blackish at base and apex.

By most of the above characters it more closely resembles *evectus* Cresson, from which the clypeal and mandibular structure will distinguish it.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25018, U.S.N.M.

One male from Mrs. Annie T. Slosson.

(EXOLYTUS GRANDIS Ashmead MS.)=ATRACTODES GRANDIS Cushman.

(HADRODACTYLUS AFFINIS Ashmead MS.)=ALEXETER RIPARIUS (Davis).

HEMITELES (ISDROMAS) WASHINGTONENSIS, new species.

"*Stiboscopus washingtonensis* Ashm., n. sp.," Slosson, Ent. News, vol. 17, 1906, p. 324.

Closely related to the so-called genotype, *Acrolyta* (*Isdromas*) *aletiae* Ashmead, but more slender and at once distinguishable by the black hind coxae and the white front and middle coxae and trochanters.

Female.—Length, 3.5 mm.; antennae, 3 mm.

Head polished, face opaque shagreened; temples convexly sloping; occiput shallowly concave; eyes parallel within; clypeus weakly separated, opaque, apex narrowly impressed, the impression polished, broadly truncate; malar space as long as basal width of mandible; mandibles not swollen toward base; antennae slender, thickened beyond middle and attenuate toward apex, first two flagellar joints slender and subequal, third slightly shorter; thorax opaque, shagreened above, polished laterally with more or less obscure aciculations, sternum subopaque; notauli and sternauli strong anteriorly; propodeum subpolished, more or less roughened, transverse carinae and apical abscissae of longitudinal carinae distinct, area between transverse carinae longitudinally striate; legs rather slender, areolet pentagonal in position with second intercubitus indicated by thickenings in radius and cubitus; nervulus postfurcal and inclivous; nervellus broken below middle, inclivous; first two tergites longitudinally striate, others polished; first tergite with sides divergent, straight more than twice as long as wide at apex, spiracles slightly beyond middle; second with distinct, pale, rounded thyridia; second and third indistinctly transversely impressed before apex; ovipositor sheath slightly longer than first tergite, subangulate above at apical third.

Black; mouth parts, tegulae, wing-bases, front and middle coxae and trochanters white; hind coxae black, trochanters white with a piceous spot above on basal joint; all femora testaceous with a brownish stain above toward base; tibiae and tarsi more or less infuscate, hind tibia rather distinctly annulated; calcaria white; wings hyaline, venation brown, stigma paler; all tergites narrowly margined with whitish apically; sheath blackish.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25019, U.S.N.M.

One female taken by Mrs. Annie T. Slosson.

(HIMERTOSOMA QUINQUECINCTUM Ashmead MS.)=SYRPHOCTONUS VERTEBRATUS Cushman, new species.

This specimen is the type of *vertebratus.*

HOMASPIS SLOSSONAE, new species.

"*Homaspis slossonae* Ashm.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.

Agrees in all respects with Schmiedeknecht's[5] description of the genus except that the punctuation of mesoscutum, scutellum, and face is sparse and the spiracles of first tergite are not protruding.

Male.—Length, 10 mm. Antennae beyond pedicel missing. In a larger specimen which lacks the abdomen the antennae are apparently shorter than body, thickened in middle and tapering at apex.

Head with convexly sloping temples, polished behind, opaque in front; frons, face, and clypeus sparsely punctate; clypeus apically impressed and medially emarginate; malar space very short; pronotum, mesoscutum and scutellum subpolished, sparsely punctate, the first rugose in impression; pleura polished, practically impunctate; sternum subopaque; propodeum with carinae very strong, so arranged as to form a W, irregularly rugose between and laterad of the carinae; spiracle small, nearly circular; first tergite rather broad at apex, not constricted beyond spiracles, latter not prominent, median carinae reaching nearly to apex; dorso-lateral carinae strong from base to apex, sides of petiole vertically rugose, apex of tergite longitudinally striate; second tergite obsoletely longitudinally striate, more distinctly so in basal middle; other tergites polished.

Black; clypeus, mandibles, and scape and pedicel beneath piceous; palpi pale; wings brownish hyaline, venation blackish, basally, together with tegulae, stramineous; legs testaceous, hind tibia and tarsus and femur narrowly at apex black.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Other locality.—Hanover, New Hampshire.

Type.—Cat. No. 25020, U.S.N.M.

Described from two specimens. The type is also the type of Ashmead's manuscript name.

(HYPOLEPUS (sic!) ALTICOLA Ashmead MS.)=HYPOLEPTUS MONTICOLA Cushman, new species.

Specimen returned by Ashmead to Mr. Slosson who has sent it to me for examination. The specific name is probably a *lapsus calami* for *monticola.*

---

[5] Opusc. Ichn., p. 2663.

HYPOLEPTUS MONTICOLA, new species.

"*Hypoleptus monticola* Ashm. n. sp.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.

"*Hypolepus alticola* Ashm." SLOSSON, Ent. News, vol. 17, 1906, p. 324.

At once distinguishable from Ashmead's two Alaskan species by the paler legs and shorter flagellar joints, and from *columbianus* Ashmead by the short flagellar joints.

Female.—Length, 3 mm.

Head from above nearly quadrate, temples broad and long; eyes small, only about a fourth longer than malar space; face including clypeus about as broad as long, polished, in profile straight; ocelli in an equilateral triangle, diameter of lateral ocellus about half as long as postocellar line; antennae (tips broken off) stout, basal joints of flagellum little longer than thick, middle joints thicker than long, scape as long as basal two joints of flagellum; thorax polished, compressed, notauli, prepectus, and epomia wanting; propodeum without carinae except apical remnants of lateral carinae; areolet wanting, second abscissa of cubitus about half as long as basal abscissa of radius; stigma elongate, radius before middle; legs stout, last joint of hind tarsus as long as third; abdomen polished, compressed beyond second tergite; first tergite two-thirds as wide at apex as long, slightly constricted beyond spiracles, longitudinally striate; second tergite striate in basal middle, with an oblique furrow on each side extending from near basal middle to near apical corner; ovipositor not exserted.

Piceous; head darker; mandibles, palpi, face immediately below antennae, tegulae, and wing-bases white; antennae brown, paler beneath toward base; legs pale testaceous; wings hyaline, venation pale brown.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25021, U.S.N.M.

Described from one female taken by Mrs. Annie T. Slosson.

The second record[6] is based on a male which is apparently not the same species.

ICHYRACIS (sic!) (ISCHYRACIS) AMERICANUS Ashmead MS.

"*Ichyracis americanus* Ashm. n. sp.," SLOSSON, Ent. News, vol. 17, 1906 p. 324.

Specimen found but very much mutilated. Will apparently run to *Ischyracis*.

(ISOTINA [sic!] TIBIALIS Ashmead MS.)=CHAERETYMMA VELOX (Cresson).

LABRORYCHUS CHLAMIDATUM (Provancher).

Anomalon chlamidatum PROVANCHER, Add. Faune Ent. Can., 1886, p. 82.

"*Atrometus flavifrons* Ashm. n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 6.

No attempt is made to give the full synonymy of *chlamidatum*.

---

[6] Ent. News, vol. 13, 1902, p. 321.

LAPHYROSCOPUS MENTALIS (Davis).

Polyoncus mentalis DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 307.
"*Monoblastus nigriventris* Ashm. MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 321.

(LEPTOPYGUS MONTICOLA Ashmead MS.)=LEPTOPYGUS RUGOSUS Provancher.

LEPTOPYGUS RUGOSUS (Provancher).

Porizon rugosum PROVANCHER, Faune Can. Ent., Hym. 1883, p. 378.
"*Leptopygus monticola* Ashm.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.

LIMNERIA NOTAE Ashmead.

"*Limneria notae* Ashm.," SLOSSON, Ent. News, vol. 7, 1895, p. 317.

Returned by Ashmead to Mrs. Slosson. The manuscript list shows this to be a misprint for *Campoplex nolae* (Ashmead).

LYMEON? TESTACEIPES, new species.

"*Adiostola testaceipes* Ashmead n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

In translating Foerster's key to the Hemiteloidae Ashmead interpreted " Die Leiste des II.-Haupts in der Mitte stark spitzwinklig " as " Metanotum with the apical carina strongly angulated or toothed." He therefore ran the present species by *Lymeon* in spite of the distinctly angulate occipital carina.

While I find no particular in which the species differs from the description of *Lymeon* I refer it doubtfully to that genus because of my belief that the genotypes of Foerster's genera should be selected from among the European species. Apparently no European species has been referred to *Lymeon*.

Female.—Length, 4 mm.; antennae, 3 mm.

Head and thorax shagreened impunctate; temples narrow and strongly receding; eyes large, nearly hemispherical, only slightly longer than wide, strongly divergent below; ocelli very small, in a nearly equilateral triangle; malar space a third as long as eye and much longer than basal width of mandible; clypeus short, weakly separated, broadly rounded at apex; mandibles only slightly narrowing toward apex, convex, teeth equal; palpi of ordinary length; antennae slender at base, stout beyond middle, first two flagellar joints slender, subequal, the third slightly shorter and stouter, middle joints fully as thick as long; notauli distinct anteriorly; pronotum striate in impression; sternauli strong, nearly complete, foveolate; propodeum nearly completely areolated, only the apical abscissa of median carinae lacking, apical carina especially strong and subangulate at sides; areola long pentagonal, costulae at about the middle; propodeum longitudinally rugulose apically and laterally; legs stout, especially the hind tibiae, which are slightly smaller at extreme apex than just before apex; wings without a trace of second intercubitus; nervellus broken below middle; abdomen hardly as long as head and thorax;

first tergite gradually widening toward apex, half as wide at apex as long, spiracles in middle, medially shagreened, laterally longitudinally aciculate; second and third tergites much broader than long, second faintly aciculate, third faintly shagreened; ovipositor sheath slightly longer than first tergite.

Black; mesoscutum medially, scutellum, pronotum dorsally, first tergite at apex, and second and third largely reddish; legs testaceous, paler at base; wings hyaline immaculate; mandibles and palpi stramineous antennae testaceous at base, black at tip with an incomplete white annulus on flagellar joints 5–7; ovipositor sheath pale, brown at apex.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25022, U.S.N.M.

One female taken by Mrs. Annie T. Slosson.

(MELOPHRON (sic!) ABDOMINALIS Ashmead MS.—STYLOCRYPTUS MUCRONATUS (Provancher).

(MEDOPHRON MONTICOLA Ashmead MS.)=STYLOCRYPTUS SUBCLAVATUS (Say).

MEGASTYLUS ASHMEADI, new species.

"*Aperileptus pleuralis* Ashmead, MS.," Slosson Ent. News, vol. 13, 1902, p. 321.

Female.—Length, 4.5 mm.; antennae, 3.5 mm.

Head more than half as thick antero-posteriorly as wide, subpolished-shagreened, face polished; diameter of lateral ocellus and postocellar, interocellar, and ocell-ocular lines all subequal; malar space nearly twice as long as basal width of mandibles; antennae tapering toward apex, basal joint of flagellum twice as long as second and about four times as long as thick; thorax shagreened, mesopleurum more faintly, mesoscutum very faintly so, pronotum polished, metapleurum and propodeum opaque; notauli obsolete; propodeum with both transverse carinae and the lateral carinae indicated, medially impressed before basal carina; abdomen opaque shagreened basally, subpolished apically; first tergite nearly half as wide at apex as long, spiracles subprominent, slightly before middle; abdomen compressed from base of fifth tergite, tergites beyond sixth retracted; hypopygium even with apex of abdomen; ovipositor slender, briefly exserted.

Black, with thorax and abdomen partly reddish; face brownish, yellowish above clypeus and below antennae; clypeus, mandibles, front and middle coxae, and all trochanters stramineous; palpi, tegulae, and wing bases white; scape reddish; pronotum pale at lower and humeral angles; mesopleurum below and sternum reddish; legs testaceous, the hind tarsi and their tibiae at apex fuscous; wings hyaline, venation pale brownish; abdomen beyond first tergite dark brownish with second tergite at apex and third largely reddish yellow, apical tergites narrowly pale margined.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25023, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

(MONOBLASTUS NIGRIVENTRIS Ashmead MS.)=LAPHYROSCOPUS MENTALIS (Davis).

Ashmead's type has been compared by the writer with that of Davis and is practically identical therewith.

NELIOPISTHUS NIGRIDORSUM Cushman.

"*Polysphincta erythropleura* Ashm. n. sp.," SLOSSON, Ent. News, vol. 7, 1896, p. 264; vol. 13, 1902, p. 321.

Neliopisthus nigridorsum CUSHMAN, Proc. U. S. Nat. Mus., vol. 56, 1919, p. 379.

NYTHOBIA MINUTA, new species.

"*Zaporus minutus* Ashm. MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 321.

Runs to *Zaporus* in Schmiedeknecht's[7] key as well as in Foerster's and Ashmead's. In the first it runs, because of the broad temples, almost equally as well to *Nythobia*, although the costulae are distinct. Because of its very close similarity to the genotype of *Nythobia*, I refer it to this genus.

Female.—Length, 3 mm.

Head silvery pubescent, especially on face, in dorsal view half as long as wide; temples broad, not sloping; occiput very shallowly concave; posterior ocelli tangent to a line drawn tangent to posterior margins of eyes; eyes not elevated above general surface of head, very shallowly emarginate opposite antennae; face very nearly as broad as frons, together with clypeus slightly longer than wide; malar space two-thirds as long as basal width of mandible; antennae slender (tips are broken but they are apparently longer than head and thorax). Thorax silvery pubescent, granulated; notauli entirely wanting; propodeum transversely rugulose behind, costulae present; hind legs rather long and stout, tarsus about as long as tibia, inner calcarium two-thirds as long as basitarsus; stigma narrow; radial cell broad, short, measured on metacarpus about as long as stigma, second abscissa of radius curved throughout its length; areolet wanting; nervellus unbroken. Abdomen little longer than head and thorax; first tergite rather stout, postpetiole about twice as wide as petiole; second tergite longer than broad, spiracles distinctly beyond middle, gastrocoeli far from base, round, the tergite with a transverse impression between the gastrocoeli; ovipositor not extending beyond apex of abdomen.

Black; mandibles, palpi, scape and pedicel below, tegulae, wing bases, front and middle coxae at base, their trochanters, and apical joint of hind trochanter whitish; legs testaceous, hind femur, tibia at apex and near base, and tarsi more or less piceous, tibia at base and in middle, calcaria, and tarsus at base whitish; abdomen beyond first tergite piceous, the tergites more or less yellowish red laterally; wings hyaline with pale brown venation.

---

[7] Hym. Mitteleur., 1917, pp. 591–613.

Type locality.—Mount Washington, New Hampshire.

Type.—Cat. No. 25024, U.S.N.M.

One female from Mrs. Annie T. Slosson.

(PAMMACRA [sic!] PALLIPES Ashmead=ADELOGNATHUS PERSIMILIS Cushman, new name.

The Mount Washington specimen was returned by Ashmead to Mrs. Slosson. The name should not be considered as a manuscript name but as a determination of *Catalytus pallipes* Ashmead, which Ashmead himself labeled *Pammicra*. This species is very closely related to the European *Adelognathus pallipes* (Gravenhorst).

PARABATES MONTICOLA, new species.

Perilissus paniscoides Ashmead, Trans. Amer. Ent. Soc., vol. 23, 1896, p. 187 (excluding female).

Paniscus albotarsatus Provancher, Davis, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 253 (not Provancher). [See *Alexeter albotarsatus* (Provancher).]

"*Ctenacme monticola* Ashm. MS.," Slosson, Ent. News, vol. 11, 1900, p. 320

Female.—Length, 7 mm.; antennae (incomplete).

Head very narrow behind eyes; face a third wider than long, medially roundly elevated, finely opaque with very small sparse punctures; clypeus about half as long as interfoveal line, rather narrowly truncate at apex, convex, sculptured like face; malar space very short; ocell-ocular line short but distinct; diameter of lateral ocellus equal to postocellar line. Thorax finely opaque, mesoscutum and scutellum indistinctly, sparsely punctured, pleura subpolished; scutellum strongly convex, margined only at extreme base; propodeum very obsoletely transversely striate above, apophyses entirely lacking, spiracles small, broadly oval; legs long, the femora rather stout; inner hind calcarium reaching beyond middle of basitarsus; wings large; stigma rather broad with radius at middle; areolet incomplete, second intercubitis obliterated beyond pedicel; bulla of second recurrent very broadly divided; discoidal cell barely half as wide at base as brachial is at apex; nervellus broken at about upper fourth. Abdomen little longer than head and thorax, subopaque; postpetiole more than twice as long as wide at apex and twice as long as petiole; second tergite slightly longer than wide at apex; terminal tergites rather weakly compressed; ovipositor sheath nearly as long as first tergite.

Pale flavo-ferruginous; head, pronotum, propleura, scutellum, a spot on pleurum below each wing, and mesosternum flavous; legs colored like body, front ones paler; hind tarsi white, all joints, especially fifth, reddish at apex; wings clear hyaline, stigma flavous.

Male.—Length, 6 mm.

Like female but more shining, and more slender; second intercubitus indicated though indistinct; legs more slender.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Other localities.—Sherbrook, Ontario, Canada; St. John, New Brunswick.

Type.—Cat. No. 25025, U.S.N.M.

Described from one female and three males. The type female is from Mount Washington, collected by Mrs. Annie T. Slosson, and is the type of *Ctemacme monticola* Ashmead MS. The allotype male is from Sherbrook, Ontario, and is the specimen described by Ashmead as the male of *Perilissus paniscoides*. Paratype *a* was "dipped from surface of ocean 94 miles from Nova Scotia, July 3, 1887." It is the only specimen with complete antennae. These are slightly longer than the body. Paratype *b* is 9 mm. long and somewhat brighter colored but otherwise similar to the allotype. It was taken June 8, 1902, at St. John, New Brunswick, by A. Gordon Leavitt.

(PHAEDROCTONUS COXALIS Ashmead MS.)=CYMODUSA COXALIS Cushman, new species.

(PHAENOSEMUS ALTICOLA Ashmead MS.)=STENOMACRUS ALTICOLA Cushman, new species.

PHYGADEUON ALTICOLA Ashmead MS.

"*Phygadeuon alticola* Ashm. n. sp.," Slosson, Ent. News, vol. 8, 1897. p 237.

A unique male apparently not referable to any described species.

PHYGADEUON SLOSSONAE, new species.

"*Bathymetis slossonae* Ashm., n. sp.," Slosson, Ent. News, vol. 17. 1906. p. 324.

Will not run to *Bathymetis*, where Ashmead placed it, because the lateral carina of the first tergite extends to the apex. The distinct costulae exclude it from *Phygadeuon* as restricted by Foerster, but it will not fit into any of the genera said to have the costulae.

Female.—Length, 2.5 mm.; antennae, 1.5 mm.

Head thick antero-posteriorly, temples strongly convex; eyes small, scarcely arched above contour of head, parallel within, face as broad as length of eye, subopaque, rest of head polished; clypeus very short, deeply separated, very broadly rounded at apex, the margin flange-like; malar space as long as basal width of mandible; lower tooth of mandible smaller but scarcely shorter than upper; antennae short, subclavate, first joint of flagellum shorter than second or third, second slightly longer than third, middle joints nearly as thick as long; thorax polished, pronotum obscurely wrinkled, prescutum anteriorly and metapleura obscurely punctate, notauli very short, sternauli complete; mesoscutum broader than long, flattened on disk; scutellum flat, the furrow without carinae; propodeum subopaque, completely areolated, petiolar area occupying half its length, areola hexagonal, upper hind angles barely prominent; stigma broad, radius slightly beyond middle; radial cell barely longer on metacarpus than stigma; second recurrent slightly beyond middle of areolet; cubitus obsolete beyond areolet; nervulus postfurcal; nervellus slightly broken near bottom, discoidella obsolete; legs, especially hind tibia, stout; abdomen broad, polished; first tergite medially shagreened, laterally and apically longitudinally striate, dorsal carinae distinct to spiracles, the space between broad and flat, lateral carinae strong to apex, the tergite half as broad at apex as long, curved; tergites 2–4 large, second longest, third and fourth equal; other tergites very short; ovipositor sheath slightly longer than first tergite.

Black; tergites 2 and 3 testaceous; mandibles, scape and pedicel, tegulae and wing bases pale; legs testaceous, hind tibiae and tarsi somewhat infuscate; wings hyaline, venation brown.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25026, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

(PIMPLINE n. gen. et n. sp. Ashmead)=DELOMERISTA TEXANA (Cresson).

Has been compared by the present writer with Cresson's type and is practically identical.

PLECTISCUS PARVUS, new species.

"*Aperilaptus parvus* Ashmead," Slosson, Ent. News, vol. 8, 1897, p. 237.

A typical *Plectiscus* with complete apical and lateral carinae and obsoletely defined combined areola and basal area.

Female.—Length, 3.5 mm.; antennae (incomplete); front wing, 3.5 mm.

Head polished in front view and much broader than long; eyes large, nearly semicircular in outline, as long as width of face, parallel within; malar space longer than basal width of mandible; temples strongly receding, posterior side of ocellar triangle much longer than lateral sides, the postocellar and ocell-ocular lines equal. Thorax polished; notauli obsolete; propodeum obsoletely roughened. Abdomen shagreened to middle of second tergite, thence coarsely and sparsely punctate; first tergite petiolate, postpetiole nearly twice as long as wide at apex; second much shorter than first; ovipositor sheath nearly twice as long as first tergite.

Black to piceous, with abdomen more or less pale in middle; mandibles, palpi, scape, tegulae, wing-bases, front coxae, and all trochanters whitish; front and middle legs otherwise and hind coxae stramineous; hind femur testaceous, tibia infuscate testaceous above, stramineous below, tarsus fuscous; venation brown.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25027, U.S.N.M.

One female taken by Mrs. Annie T. Slosson.

PLESIGNATHUS AMERICANUS, new species.

"*Epitomus americanus* Ashm. MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 320.

Female.—Length, 7 mm.; antennae, 5 mm.

Head thick antero-posteriorly, the temples and cheeks broad and convex, occiput very shallowly concave; vertex and temples polished, very sparsely punctate; face densely punctate, wider than frons, scarcely half as long as wide; clypeus distinctly separated basally, sparsely punctate and more or less transversely striate, apically transversely impressed and bidenticulate; malar space as long as basal width of mandible, the malar furrow represented by a broad, finely sculptured line; mouth broad, mandibles stout, punctate, teeth short, stout, equal; antennae thickened beyond middle, basal three joints of flagellum elongate, subequal, second slightly the longest; thorax polished, sparsely punctate; pronotum obscurely striate in impression; notauli very short; sternauli nearly complete; mesoscutum and scutellum flattened above; propodeum completely areolated, carinae strong, basal median and lateral areas polished, others subopaquely sculptured; areola hexagonal, emarginate behind, petiolar area rather narrow, concave, superior angles slightly prominent; legs rather stout; areolet apparently open, the second intercubitus completely bullated; cubitus wanting beyond areolet; radius beyond middle of stigma; radial cell measured on metacarpus hardly longer than stigma; second discoidal cell much wider at base than is brachial at apex; nervellus broken far below middle, discoidella obsolete; abdomen broad, polished; first tergite slender, curved, more than twice as long as wide at apex, spiracles at apical third, dorsal carinae reaching half way beyond spiracles, lateral carinae weak beyond spiracles; tergites beyond fourth very short; ovipositor barely exserted.

Black; with tergites 2 and 3 and legs (largely) testaceous; mandibles reddish; antennae ferruginous at base, black in middle, brown at apex; tegulae piceous; middle femur above, hind legs largely fuscous, trochanters stramineous, coxae testaceous.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25028, U.S.N.M.

One female taken by Mrs. Annie T. Slosson.

POLYAULON COMPRESSUM, new species.

"*Diatora compressa* Ashm. MS. n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 320.

Runs to *Polyaulon* in Foerster's key to the Plectiscoidae and agrees with the description except that the ovipositor is distinctly exserted and the nervulus is interstitial.

Female.—Length, 3 mm.; antennae, 2 mm.

Head polished, broad behind eyes, face subopaque, half as long as broad; clypeus polished, sharply separated, two-thirds as long as broad, somewhat compressed from sides, strongly rounded both basally and apically; malar space much longer than basal width of mandible and nearly half as long as eye; ocelli very small, in a nearly equilateral triangle; antennae rather slender, thicker toward apex, flagellar joints strongly ridged longitudinally, first three times as long as thick, those toward apex as thick as long; thorax compressed; mesoscutum and scutellum polished; pronotum and mesopleurum subpolished coriaceous; sternauli distinct anteriorly; metapleurum and propodeum opaque coriaceous, petiolar area subpolished, areolation complete, petiolar area occupying more than half dorsal length, areola hexagonal; legs, especially hind tibia, rather stout, hind legs long, femora reaching beyond apex of third tergite; stigma narrow, radius at its middle; metacarpus two-thirds as long beyond radius as before; no trace of second intercubitus; second recurrent curving strongly toward apex of wing, its angle with subdiscoideus acute; discoidal cell broad at apex, narrow at base, nervulus interstitial; nervellus unbroken, reclivous; abdomen one and one-half times as long as head and thorax, compressed from base of fourth tergite, first tergite opaque, others polished; first tergite nearly three times as long as wide at apex, postpetiole but little wider than petiole, spiracles slightly behind middle, in profile arched above, straight beneath; second tergite nearly as long as first, slightly longer than wide at apex; third to fifth gradually shorter, others very short; ovipositor sheath nearly as long as first tergite.

Black; mandibles and palpi pale; antennae at base and legs testaceous; abdomen beyond first tergite piceous; wings hyaline, venation brown.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25029, U.S.N.M.

One specimen taken by Mrs. Annie T. Slosson.

The compression of the thorax and abdomen give this species an appearance like the Orthocentrini, while the sternauli and narrow first tergite are suggestive of the Hemitelini; but the compressed clypeus and venation, notably the discoidal cell and nervellus, indicate its Plectiscine affinities.

(POLYCLISTUS FRONTALIS Ashmead MS.)=EXOCHUS MANDIBULARIS Cushman, new species.

(POLYSPHINCTA ALBOCOXALIS Ashmead MS.)=COLPOMERIA KINCADII (Ashmead).

There are two specimens from Mount Washington. These are part of the material studied in connection with my revision of the tribe Polysphinctini.

POLYSPHINCTA ELONGATA Cushman.

Polysphincta elongata CUSHMAN, Proc. U. S. Nat. Mus., vol. 58, 1920, p. 25.
"*Ephialtomorpha slossonae* Ashm. n. gen. et. n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

(POLYSPHINCTA ERYTHROPLEURA Ashmead MS.)=NELIOPISTHUS NIGRIDORSUM Cushman.

There were apparently two specimens of this species, since it appears in two of the lists, but only one has been found. This is the type of *nigridorsum*, and is probably the 1896 specimen. The 1902 specimen was returned to Mrs. Slosson.

POLYSPHINCTA TRICOLOR Ashmead MS.

"*Polysphincta tricolor* Ashm. n. sp.," SLOSSON, Ent. News, vol. 11, 1900, p. 320.

Retained by Ashmead but not found in National Collection.

(PROEDRUS DELICATUS Ashmead MS.)=APERILEPTUS DELICATUS Cushman, new species.

(PROMETHES ALBICOXIS Ashmead MS.)=PROMETHES ELONGATUS (Provancher).

PROMETHES ELONGATUS (Provancher).

Bassus elongatus PROVANCHER, Nat. Can., vol. 6, 1874, p. 57; Faune Ent. Can., Hym., 1883, p. 799.
Bassus ichneumonoides, var. *elongatus* PROVANCHER, Nat. Can., vol. 11, 1879, p. 277; Faune Ent. Can., Hym., 1883, p. 433.
Promethus elongatus DAVIS, Trans. Amer. Ent. Soc., vol. 22, 1895, p. 21.
Otoblastus erodens DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 273.
"*Promethus albicoxis* Ashm. n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

PROTARCHOIDES, new genus.

Closely related to *Protarchus* Foerster, from which it differs principally as follows: Head and thorax more finely punctate, the face densely so; frons very shallowly concave, without tubercles laterally; ocelli smaller, the space between barely impressed; temples strongly convex; notauli distinct but not especially deep anteriorly, becoming obsolete far before middle; second abscissa of radius nearly straight; hind tibia at apex and the tarsus strongly compressed, last tarsal joint not nearly twice as long as fourth and much shorter than third; inner calcarium not nearly half as long as basitarsus.

Type.—Protarchoides longipes Cushman, new species.

PROTARCHOIDES LONGIPES, new species.

"*Psilosarge longipes* Ashm. MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 321.

Female.—Face slightly narrower than frons, medially roundly elevated, about half as long as wide; clypeus opaque and sparsely punctate basally, polished in apical impression; mandibles swollen before middle; malar space a third as long as basal width of mandible; eyes slightly longer than width of face; diameter of lateral ocellus three-fifths as long as ocell-ocular line which is equal to postocellar line; thorax densely punctate throughout except the small speculum; mesoscutum and scutellum least densely so; propodeum rugose posteriorly, petiolar area two-fifths as long as dorsal face of propodeum; lateral abscissae of apical carina obsolete; areolet small with a long petiole; discocubitus sinuate, without a ramellus; first tergite concave but without deep pits dorsally opposite spiracles.

Black; this color including the entire abdominal venter; antennae brown, flagellum reddish beneath nearly to base but not at apex; maxillary palpi stramineous, labial piceous; legs bright testaceous, hind tibia and tarsus black; wings hyaline, venation dark brown, costa paler; tegulae nearly black.

Type locality.—Alpine region of Mount Washington, New Hampshire.

Type.—Cat. No. 25030, U.S.N.M.

One female taken by Mrs. Annie T. Slosson.

(PSILASARGE [sic!] LONGIPES Ashmead MS.)=PROTARCHOIDES LONGIPES Cushman, new species.

(PYRACMON CLYPEATUM Ashmead MS.)=XENOSCHESIS SLOSSONAE Cushman.

This specimen is the type of *slossonae*.

***SCOPESIS FLAVIFRONS (Ashmead).**

Hyposyntactus flavifrons ASHMEAD, Proc. Wash. Acad. Sci., vol. 4, 1902, p. 217, pl. 10, fig. 4, male only.

SCOPESIS MONTICOLA, new species.

"*Scopasis monticola* Ashm. n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 6.

Differs from *flavifrons* (Ashmead) and *pictus* (Davis) in having the clypeus distinctly swollen and medially protruding before the transverse apical impression, this swelling overlying and concealing the impression in the middle, and in the somewhat less extensive and paler yellow marking of the abdomen. In the female it differs further from *pictus* in having the face entirely yellow and the middle femur largely black. In the male it differs from both by the basally black front and middle coxae; from *pictus* in having the postscutellum black; and from *flavifrons* in lacking the yellow markings laterally on mesoscutum.

Female.—Length, 9 mm.; antennae, 7 mm.

Head and thorax opaque shagreened, face and lower mesopleura and sternum finely, sparsely punctate; temples sloping, nearly straight; face slightly narrower than frons, flat; clypeus swollen before apical impression, polished, rather deeply emarginate; malar space less than half as long as basal width of mandible; eyes large, bulging; epomia present; notauli shallow and fading out before middle of mesoscutum; scutellum elevated, slightly compressed toward apex; propodeum with lateral and apical carinae strong, median carinae weaker but distinct, areola distinct, triangular; hind femur about five times as long as thick; nervulus slightly postfurcal; nervellus broken below middle; abdomen subpolished, finely shagreened; first tergite opaque, postpetiole longer than wide at apex, dorsal carinae not extending beyond petiolar basin.

Black; face, clypeus and mandibles yellow; antennae brown, black at base, scape and pedicel more or less yellow below; palpi whitish; thorax without yellow markings except very small humeral spots on pronotum; coxae black, front and middle ones yellow at apex; middle femur except at apex, hind femur entirely, and hind tibia at apex black; legs otherwise yellow; wings pale yellowish hyaline, venation brown, stigma paler, wing-bases and tegulae yellow; abdomen black with second and third segments, both tergites and sternites, yellow.

Male.—Differs from female practically only in having the hind femur somewhat stouter; yellow spots at origins of notauli and below front wings; front and middle coxae more largely yellow; middle femur stramineous; hind tarsi brownish.

Type locality.—Franconia, New Hampshire.

Other localities.—Alpine region of Mount Washington, New Hampshire (Mrs. Slosson); Hanover, New Hampshire (C. W. Johnson).

Type.—Cat. No. 25031, U.S.N.M.

Described from two females from the first two localities mentioned and one male from the last locality. The female paratype is like the type. The allotype has the second tergite largely black, but this is evidently exceptional for the genus.

SCOPESIS PICTUS (Davis).

Mesoleptus pictus DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 315.

(SCORPIORUS [sic!] ALBOMARGINATUS Ashmead MS.)=EUCEROS ALBOMARGINATUS Cushman, new species.

(SCORPIORUS [sic!] FLAVOPICTUS Ashmead MS.)=EUCEROS COUPERI Cresson.

STENOMACRUS ALTICOLA, new species.

"*Phaenosemus alticola* Ashm., n. sp.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.

Differs from *Phaenosemus* by all of the characters given by Foerster in the first alternate of couplet 11 of his key to the Orthocentroidae, but runs beyond this point, falling into *Stenomacrus* because of the long stigma with the radius originating near its base.

In Davis's key to North American species of *Stenomacrus*[8] runs to *hastatus* Davis, from which it differs in being smaller and more slender and having the antennae more slender with the flagellar joints relatively much longer.

Female.—Length, 2.5 mm.

Polished; face and mesoscutum sparsely punctate; first tergite and base of second opaque rugulose; face, including clypeus, as wide as long; malar space two-thirds as long as eye; temples strongly receding; ocellar triangle slightly longer behind than on sides, the ocelli a little longer than postocellar line; antennae stout, first flagellar joint about two-thirds as long as scape and slightly less than twice as long as thick; propodeum with strong apical, median, and lateral carinae, other carinae absent, combined areola and basal area parallel-sided and about three times as long as wide and about a third longer than petiolar area; angle of radius nearly right; second abscissa of cubitus hardly half as long as first abscissa of radius; nervulus postfurcal; nervellus straight, reclivous; legs stout, tarsi slender; hind coxae reaching beyond apex of first tergite; first tergite with deep furrows laterally between spiracles and apex, the dorsal carinae strong to these furrows; abdomen compressed from base of third tergite.

Piceous; mandibles, palpi, wing bases (but not tegulae) white; antennae dark brown, paler beneath basally; legs testaceous, front and middle ones stramineous basally; wings hyaline, venation light brown.

Type locality.—Mount Washington, New Hampshire.

Type.—Cat. No. 25032, U.S.N.M.

Described from one female taken by Mrs. Annie T. Slosson.

The specimens recorded under *Phaenosemus alticola* in the 1902 and 1906 lists are not the same species, but apparently represent two other undescribed species which are not described here because of the poor condition of the specimens.

(STIBOSCOPUS WASHINGTONENSIS Ashmead MS.)=HEMITELES (ISDROMAS) WASHINGTONENSIS Cushman, new species.

STYLOCRYPTUS MUCRONATUS (Provancher).

Phygadeuon mucronatus PROVANCHER, Faune Ent. Can., Hym., 1883, p. 319.

"*Melophron abdominalis* Ashm., n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.

STYLOCRYPTUS SUBCLAVATUS (Say).

Cryptus subclavatus SAY, Boston Journ. Nat. Hist., vol. 1, 1835, p. 237 (LeConte ed., vol. 2, 693).

Phygadeuon rotundiceps PROVANCHER, Nat. Can., vol. 9, 1877, p. 12.

"*Medophron monticola* Ashm. MS.," SLOSSON, Ent. News, vol. 11, 1909, p. 319.

Stylocryptus subclavatus (Say), CUSHMAN and GAHAN, Proc. Ent. Soc. Wash., vol. 23, 1921, p. 162.

---

[8] Trans. Amer. Ent. Soc., vol. 24, 1897, p. 224.

(SYRPHOCTONUS BILINEATUS Ashmead MS.)—SYRPHOCTONUS VERTEBRATUS Cushman, new species.

This specimen is Partype *b* of *Syrphoctonus vertebratus.*

SYRPHOCTONUS VERTEBRATUS, new species.

"*Syrphoctonus bilineatus* Ashm. n. sp.," SLOSSON, Ent. News, vol. 11, 1900, p. 320.

"*Himertosoma quinquecinctum* Ashm. MS. n. sp.," SLOSSON, Ent. News, vol. 13, 1902, p. 320.

The very striking herringbone pattern of the abdomen, at least in the male, distinguishes this species from any of the described North American species.

From the male of *maculifrons* (Cresson), to which it runs in Davis's key, it differs principally as follows:

Male.—Length, 5 mm.; antennae, 4.5 mm.

Face two-thirds as long as wide, narrower than frons; clypeus separated medially from face, elevated basally, and with a short median sulcus at apex; malar space nearly as long as basal width of mandible; vertex, frons, and temples polished, faintly shagreened but without punctures; ocelli in a rather high triangle, postocellar and ocell-ocular lines equal. Thorax polished, impunctate, though very faintly shagreened laterally on pronotum and on mesoscutum; scutellar fovea very finely foveolate; propodeum subpolished, finely coriaceous; second abscissa of cubitus much longer than intercubitus; discocubitus broadly curved, not subangulate; nervulus interstitial; postnervulus broken above middle, nervellus below the middle; legs very slender; longer hind calcarium reaching barely a third the length of basitarsus. Abdomen narrow; first tergite equally wide at base and apex, more than twice as long as wide at apex, spiracles very prominent, nearly at middle; abdomen shining, the basal tergites more or less longitudinally striate basally and shagreened in middle, their apices and the apical tergites polished.

Black to piceous with the following parts yellow; mouth, face frontal orbits, scape, pedicel, basal few joints of flagellum, pronotum except brownish stain in middle, propleura, lateral margins and positions of notauli on mesoscutum, scutellum, postscutellum, tegulae, mesopleurum except above, mesosternum, apical spot on first tergite, a large triangular spot on each of the next six tergites having its base at or near apex of the tergite and its apex at or near the base of the tergite, these spots faint on sixth and seventh tergites, venter, all coxae and trochanters, and front and middle femora; legs otherwise pale testaceous, the hind tarsi somewhat dusky; antennae brown, stigma pale.

Type locality.—Mount Washington, New Hampshire.

Type.—Cat. No. 25033, U.S.N.M.

Described from three males taken by Mrs. Annie T. Slosson.

(TEMELUCHA SCUTELLATA Ashmead MS.)=CREMASTUS LONGIGENALIS Cushman.

One of the Mount Washington specimens is the type of *longigenalis.* A second specimen was returned by Ashmead to Mrs. Slosson, and is among the specimens sent to me by Mrs. Slosson.

THERSILOCHUS PROVANCHERI, new name. (=THERSILOCHUS PALLIPES Provancher, not Holmgren.)

"*Thersilochus provancheri* Ashm.," SLOSSON, Ent. News, vol. 11, 1900, p. 320.

The Mount Washington specimen to which Ashmead assigned this name was returned by Ashmead to Mrs. Slosson, but other specimens in the National Collection show this to be a new name that Ashmead intended to propose for *pallipes* Provancher, preoccupied by Holmgren in 1858.

(TRACHYPORTHUS (sic!) AMERICANUS Ashmead MS.)=ADELOGNATHUS AMERICANUS Cushman, new species.

XENOSCHESIS SLOSSONAE Cushman.

"*Pyracmon clypeatum* Ashm.," SLOSSON, Ent. News, vol. 8, 1897, p. 237.
"*Erigloea longitarsis* Ashm. n. sp.," SLOSSON, Ent. News, vol. 17, 1906, p. 324.
Xenoschesis slossonae CUSHMAN, Proc. Ent. Soc. Wash., vol. 17, 1915, p. 140.

(ZAPORUS ALTICOLA Ashmead MS.)=DIOCTES ALTICOLA Cushman, new species.

(ZAPORUS MINUTUS Ashmead MS.)=NYTHOBIA MINUTA Cushman, new species.

(ZOOTREPHES BICOLORIPES Ashmead MS.)=ZOOTREPHES CULTRIFORMIS (Davis).

ZOOTREPHES CULTRIFORMIS (Davis).

Otoblastus cultriformis DAVIS, Trans. Amer. Ent. Soc., vol. 24, 1897, p. 273.
"*Zootrephes bicoloripes* Ashm. MS.," SLOSSON, Ent. News, vol. 13, 1902, p. 321.

Davis places this and four other species of Diplazonini in the Tryphonini because of the supposed lack of the division of the upper tooth of the mandible. I have seen the types of all five and find that Davis was mistaken as to the mandibles.

The present species is very close to, if not synonymous with (Tryphon) *Zoothrephes compressiventris* (Cresson), also referred by Davis to *Otoblastus*, differing only in lacking the cuneiform yellow spots on mesoscutum. It is doubtful if this difference is specific.

The other species referred by Davis to *Otoblastus* should be disposed of as follows:

***(TRYPHON) ZOOTREPHES COMPRESSIVENTRIS (Cresson) (=ZOOTREPHES MONTANUS Davis).**

***(OTOBLASTUS) PHTHORIMA? BIDENS (Davis).**

This is a male which runs to *Phthorima*, but since that genus is known to me only in the female I refer the present species to it doubtfully.

***(TRYPHON) SYRPHOCTONUS MINIMUS (Cresson)=(SYRPHOCTONUS PACIFICUS [Cresson]).**

(OTOBLASTUS ERODENS Davis)=PROMETHES ELONGATUS (Provancher).

See also *Promethes elongatus* above.

A NEW GENUS OF TREMATODES FROM THE WHITE BASS.

By H. J. Van Cleave,
Of the University of Illinois, Urbana, Illinois.

INTRODUCTION.

During the summer of 1919, the writer was engaged in investigations for the United States Bureau of Fisheries upon worm parasites in fishes of the Mississippi River and some of its tributary streams and lakes. Collections were made in Iowa, Illinois, and Minnesota. In the course of this work some unusual trematodes were encountered in the digestive tract of the white bass, *Roccus chrysops* (Rafinesque). These, in some superficial respects, resemble members of the genus *Acanthochasmus* of Looss, but the internal organization differs so pronouncedly from that of any recognized species of *Acanthochasmus* that it becomes necessary to erect a new genus for which the name *Allacanthochasmus* is proposed.

Looss (1899:579) has aptly shown that superficial resemblances are not sound criteria for the determination of phylogenetic relationships between trematode genera when he pointed out the essential differences between the two genera *Acanthochasmus* and *Stephanochasmus.* In like manner he called attention to the fundamental differences which exist between these two genera and the genus *Echinostomum* even though all three of these genera display a pronounced crown of oral spines. The presence of conspicuous spines around the oral orifice, though a conspicuous character. is in itself of little or no phylogenetic significance. Accepting this same fundamental hypothesis, Odhner (1911:522) has maintained that the two genera *Caecincola* and *Cryptogonimus* are closely related to the genus *Acanthochasmus* in spite of the fact that in them oral spines are lacking. On the other hand, in comparing the trematodes from the white bass with others having the oral crown of spines, unique conditions in the relative position of testes, ovary, and uterus and numerous other differences of fundamental importance are encountered.

This paper forms one of the contributions from the United States Bureau of Fisheries Biological Station, Fairport, Iowa, and from the Zoological Laboratory of the University of Illinois, No. 194.

MATERIALS.

The materials upon which this study was carried on were taken from various locations in the area under consideration. Individuals were first encountered in the intestine of *Roccus chrysops* at New Boston, Illinois, June 30, 1919. By far the greatest part of the collecting was done during July and August on Lake Pepin at Lake City, Minnesota. A few specimens of the host from Lake Pokegama at Pine City, Minnesota, were also examined and found to be infested with this parasite. A single individual of the white bass taken from the Mississippi River at Fairport, Iowa, bore a moderate infestation of *Allacanthochasmus.* A considerable number of prepared whole mounts of these trematodes were very kindly turned over to the writer by Prof. A. S. Pearse who collected the specimens in the course of his investigations at Lake City, Minnesota, during the summer of 1920. From one host individual of this collection a number of liver cysts contained egg-bearing trematodes of the same species as those encountered in the intestine of the same host. The writer is unable to determine how these individuals reached this unusual place.

In September, 1913, the writer made rather extensive collections of fish parasites at Sandusky, Ohio. Subsequently only a portion of the material of this collection was worked over and the species determined. Recent examination of some of the previously undetermined trematodes from *Roccus chrysops* has revealed the fact that they are of the same species discovered in the white bass of the Mississippi Basin. It would thus seem that the geographical distribution of this trematode is probably coincident with that of its host or at least the parasite occurs through much of its range.

Members of the genus *Allacanthochasmus* seem to be remarkably adapted to their host for infestation is apparently specific. Of the hundreds of fishes examined, representing all of the usual species in the regions investigated, not a single specimen of *Allacanthochasmus* was encountered in any host other than *Roccus chrysops.* Every specimen of the white bass examined carried an infestation and in many instances the parasite was present in large numbers. The worms of this species are very minute and apt to escape observation even though they may be present in great numbers, for they become obscured in the intestinal material.

Mature individuals show extreme variability in size. The differences are so marked that one might feel inclined to consider the largest and the smallest as specifically distinct were it not for the fact that these extremes are united by a series of fine gradations.

In spite of the fact that body musculature is not excessively developed, these worms both in the living and the preserved condition display the results of unusual powers of general and localized contraction. As a result, not only body length and diameter show extreme variability but the relative position of internal organs and superficial structures display just as surprising instability. The series of drawings in figure 1, A to G, well illustrate the characteristic differences in body size and shape and also show individual peculiarities in the relative position of the acetabulum and in the arrangement of the testes. Diagnosis of genus and of species are rendered extremely difficult because of the instability of so many characters in these worms. In the following description of the genus it is entirely possible that some of the characters cited as of generic significance may prove to be of only specific value. The description of any monotypic genus is usually subject to emendation upon the discovery of additional species.

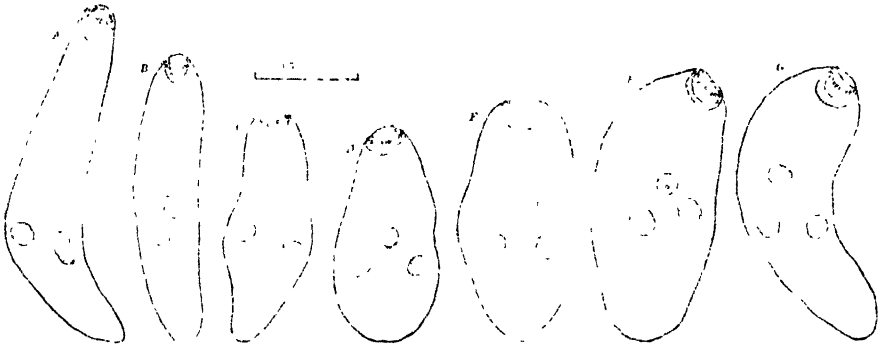


FIG. 1.—SERIES OF OUTLINE DRAWINGS, ALL TO SAME SCALE, SHOWING RELATIVE SIZE AND BODY FORM OF INDIVIDUALS OF ALLACANTHOCHASMUS VARIUS. RELATIVE POSITION OF ACETABULUM AND TWO TESTES SHOWN IN EACH DRAWING.

ALLACANTHOCHASMUS, new genus.

Diagnosis.—Small distomid trematodes living in the digestive tract of fresh-water fishes. Body highly variable in form. Oral sucker prominent, surrounded by a single complete circle of spines; the entire oral region strongly resembling that of the genus *Acanthochasmus* Looss. Entire body surface covered with minute, closely applied cuticular spines. Acetabulum in fully extended or completely contracted individuals almost in center of ventral surface. Genital orifice anterior to acetabulum (fig. 2.) Prepharynx and esophagus lacking. Vitellaria along lateral margins of body anterior to testes and grouped around intestinal crura, variable in extent of distribution. Testes almost lateral in some contracted specimens, more frequently obliquely situated in the body and in some instances almost one directly behind the other. Ovary lobed, occupying practically the entire width of body anterior to the testes and posterior to the acetabulum.

Type species.—Allacanthochasmus varius, new species.

ALLACANTHOCHASMUS VARIUS, new species.

Plate 1 and text figures 1 and 2.

Diagnosis.—With the characters of the genus. Body length of mature worms variable from 0.58 to 2.4 mm. Relation of body length to diameter subject to great range due to states of contraction. Diameter of crown of spines around mouth about 0.18 to 0.25 mm. Individual spines of oral circle usually about 41µ long though they frequently range from 35 to 53µ. Usually 24 spines in the oral circle though in some instances a smaller number has been observed and in one individual 28 were present. Oral sucker 0.150 to 0.240 mm. across at widest part. Pharynx located directly posterior to oral sucker and at its posterior margin giving rise to the bifurcated intes-

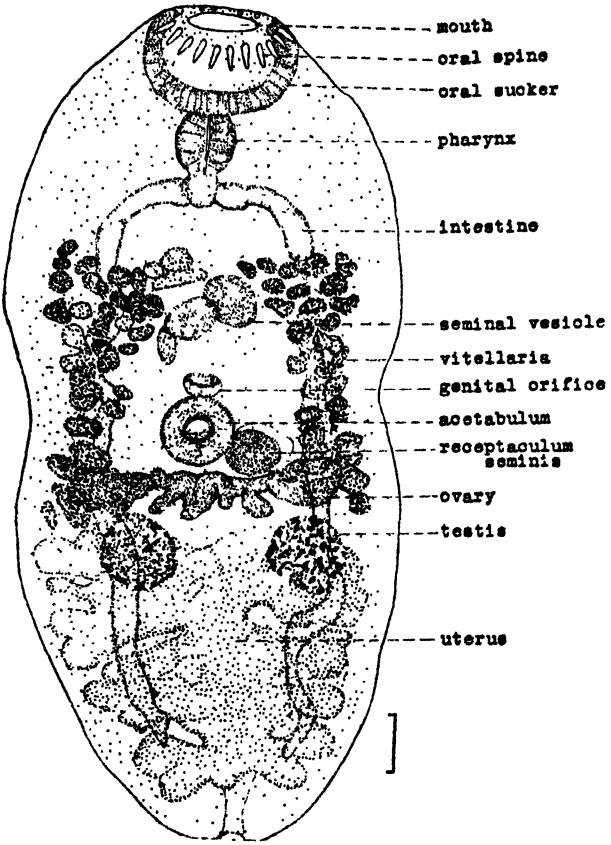


FIG. 2.—DETAILS OF STRUCTURE OF ALLACANTHOCHASMUS VARIUS. THE UTERUS IS COMPLETELY FILLED WITH EGGS, BUT FOR CONVENIENCE IN THIS DRAWING IS SHOWN IN FLAT STIPPLING. VITELLARIA OF DORSAL INTERCECAL REGION HAVE BEEN OMITTED, AS HAVE ALSO THE CUTICULAR SPINES. THE SCALE ACCOMPANYING THIS DRAWING HAS THE RELATIVE VALUE OF 0.1 MM.

tine the crura of which extend posteriorly to within a short distance from the posterior extremity of the body. Ovary a lobed band across the body posterior to the acetabulum and laterally reaching a position slightly beyond the intestinal crura. Testes rounded or slightly elongated, from 80 to 150µ in diameter. Vitellaria surrounding the intestine and extending forward from the ovary to a short distance posterior to the pharynx; on dorsal surface scattered over entire intercecal field. Receptaculum seminis located laterally between the acetabulum and the ovary. Seminal vesicle a coiled tube near the median plane about midway between the acetabulum and the pharynx. Uterus heavily massed in posterior region of body and extending forward to the anterior margin of the testes, filled with eggs about 18µ in diameter. Development unknown.

Type host.—*Roccus chrysops* (Rafinesque) from Mississippi River and tributary lakes, also from same host at Sandusky, Ohio.

Type.—Cat. No. 7634, U.S.M.M.; *paratypes* Cat. No. 7635, U.S.N.M. and in the collection of the writer at Urbana, Illinois.

Variability.—Within this species variations in shape and size are so pronounced that it becomes difficult to appreciate the fact that in other trematodes size and general body form must be relatively more stable. Investigators have frequently based contentions for specific distinctions upon characters which observations of living specimens have demonstrated to be very highly modifiable in the individuals of *A. varius*. In this species contraction and extension of different parts of the body seem to be subject to distinctly localized control, for almost any part of the body may be in a state of contraction or of extension regardless of the state of its adjoining parts. The results of such uncorrelated actions of the body are shown in the typical instances given in figure 1 (A to G). In the varying states of contraction of the individual there is usually a slight constriction of the lateral margins in the region of the acetabulum and genital orifice, but in fully extended individuals this constriction is less marked.

The influence of contraction of the body seems to be manifest even in the arrangement of some of the internal organs. The testes in a contracted specimen lie almost purely lateral in position (fig. 1, D and E). In slightly less contracted individuals they lie obliquely in the body (A and C) and in some extreme instances (B) one is almost directly posterior to the other. The possibility of the mechanical pressure of the gravid uterus crowding the testes into the lateral position might be suggested. In a number of instances immature individuals in which no eggs were yet accumulated in the uterus (pl. 1, fig. 6) shows the testes in distinctly lateral position.

The entire oral region is conspicuously modifiable even in the same individual. Figures 3, 4, and 5 show some of the typical views of this region. In figure 5 the anterior extremity is distinctly truncated with the oral spines arranged about the margin of a flattened area which in its center bears the mouth opening. A rather unusual condition is shown in figure 4. Naturally the oral sucker in its functional operations undergoes conspicuous movements through the operation of its powerful muscles. As a result the sucker may be either broad and shallow or narrow and deep with all intermediate stages between the two conditions. Some of these stages are shown in text figure 1.

Surface structures such as the acetabulum and the genital orifice are also subject to considerable modifiability in relative positions as well as general form. While the acetabulum is usually circular in outline it is distinctly elongated in the transverse axis in many preserved specimens. The position of the genital orifice with reference to the acetabulum is subject to some variability which is probably directly correlated with the muscular state of the immediately surrounding region of the body wall. In some individuals the crescentic elevation which bears the genital orifice is directly in contact with the anterior margin of the acetabulum, but still others show these two structures separated by a distance as great as the diameter of the prominence which bears the orifice. That these differences are not due to the mobility of the acetabulum alone is evidenced by the fact that separation of the two structures is just as frequently encountered in specimens which have an acetabulum perfectly circular in outline as in those with an elongated lateral axis.

Relationships.—Odhner (1911:522) has maintained that certain genera of trematodes which lack oral spines despite that lack still must belong to the same family as Looss's genus *Acanthochasmus. Caecincola* and *Cryptogonimus*, two genera from fresh-water fishes of North America, are cited in his discussion of this interrelationship. The genus *Allacanthochasmus* in its fundamental organization rather closely approaches the conditions found in Osborn's genus *Cryptogonimus.* It seems possible, then, that the genus *Allacanthochasmus* provides an additional link in the chain of relationships so strongly maintained by Odhner. A few specimens of *Caecincola* were encountered as a simultaneous infestation with *Allacanthochasmus* in the white bass. In these few individuals the extreme development of the uterus prevented thorough study of the internal organization, but all available evidence corroborates the identification of the species as *Caecincola parvulus* Marshall and Gilbert.

Linton (1898:535) described *Distomum tenue* from the rectum of the striped bass (*Roccus lineatus*) at Woods Hole, Massachusetts. In some respects *Allacanthochasmus varius* simulates the conditions in *D. tenue*, but upon close observation it is readily seen that in arrangement of the oral spines, location of the reproductive organs, location of the uterus, size of eggs, relative size of the acetabulum, and in many other features the two organisms differ so extremely they could not be included within the same genus. The superficial resemblances between these two trematodes is of especial interest because their respective hosts are members of the genus *Roccus.*

Forbes and Richardson (1908:320) have referred to the similarity in "range, local preferences, feeding habits, and food" of *Roccus chrysops* and *Morone interrupta.* Since *Morone interrupta* (yellow bass) is the only close relative of *R. chrysops* in the region under investigation, the writer endeavored to ascertain if this relationship was in any manner reflected in the parasitic fauna of the two species. Not a single specimen of *Allacanthochasmus varius* was encountered in *M. interrupta* even in regions where *R. chrysops* was heavily and generally infested by this trematode. The only trematodes encountered in *M. interrupta* belong to an unidentified species, probably of the genus *Allocreadium*, though the cuticula is provided with minute spines. This form was entirely wanting in *R. chrysops.* Regardless of their close phylogenetic and ecological relationships these two species of fish display marked diversity in their respective trematode faunas.

SUMMARY.

1. *Allacanthochasmus varius*, a new genus and species of trematodes, is described.

2. This parasite occurs in the intestine of the white bass (*Roccus chrysops*) of the Mississippi River and some of its tributaries and from the same host at Sandusky, Ohio. No other host has been encountered.

3. Individuals of this species are subject to pronounced variability in form and in relative position of various structures.

4. The trematode fauna of *Morone interrupta*, a near relative of *Roccus chrysops*, is entirely distinct from that of *R. chrysops.*

REFERENCES.

FORBES, S. A., and RICHARDSON, R. E. 1908. The Fishes of Illinois. Natural History Survey of Illinois, vol. 3, St. Lab. Nat. Hist.

LINTON, E. 1898. Notes on trematode parasites of fishes. Proc. U. S. Nat. Mus., vol. 20, pp. 507–548.

LOOSS, A. 1899. Weitere Beiträge zur Kenntniss der Trematoden-Fauna Aegyptens, zugleich Versuch einer natürlichen Gliederung des Genus *Distomum* Retzius. Zool. Jahrb., Abt. f. Syst., vol. 12, pp. 521–784.

——— 1901. Natura doceri, eine Erklarung und Begründung einiger Grundsätze, welche mich bei meinen "Versuche einer natürlichen Gliederung des Genus Distomum Retzius" geleiter haben. Centralbl. f. Bakt., Parasitenk, u. Infektionskr. Abt. 1, vol. 29, pp. 191–210.

Looss, A. 1901a. Ueber die Fasciolidengenera Stephanochasmus, Acanthochasmus und einige andere. Centralbl. f. Bakt., Parasitenk, u. Infektionskr. Abt. 1, vol. 29, pp. 595–606, 628–634, and 654–661.

Marshall, W. S., and Gilbert, N. C. 1905. Three new Trematodes found principally in Black Bass. Zool. Jahrb., Abt. f. Syst., vol. 22, pp. 477–488.

Odhner, T. 1911. Zum natürlichen System der digenen Trematoden IV. Zool. Anz., vol. 38, pp. 513–531.

EXPLANATION OF PLATE.

Allacanthochasmus varius, new species.

A camera lucida was employed in making all drawings. The scale accompanying the drawings in every instance has the relative value of 0.1 mm. All drawings from stained toto-mounts in balsam.

Fig. 1. Anterior portion of a specimen viewed from ventral surface.

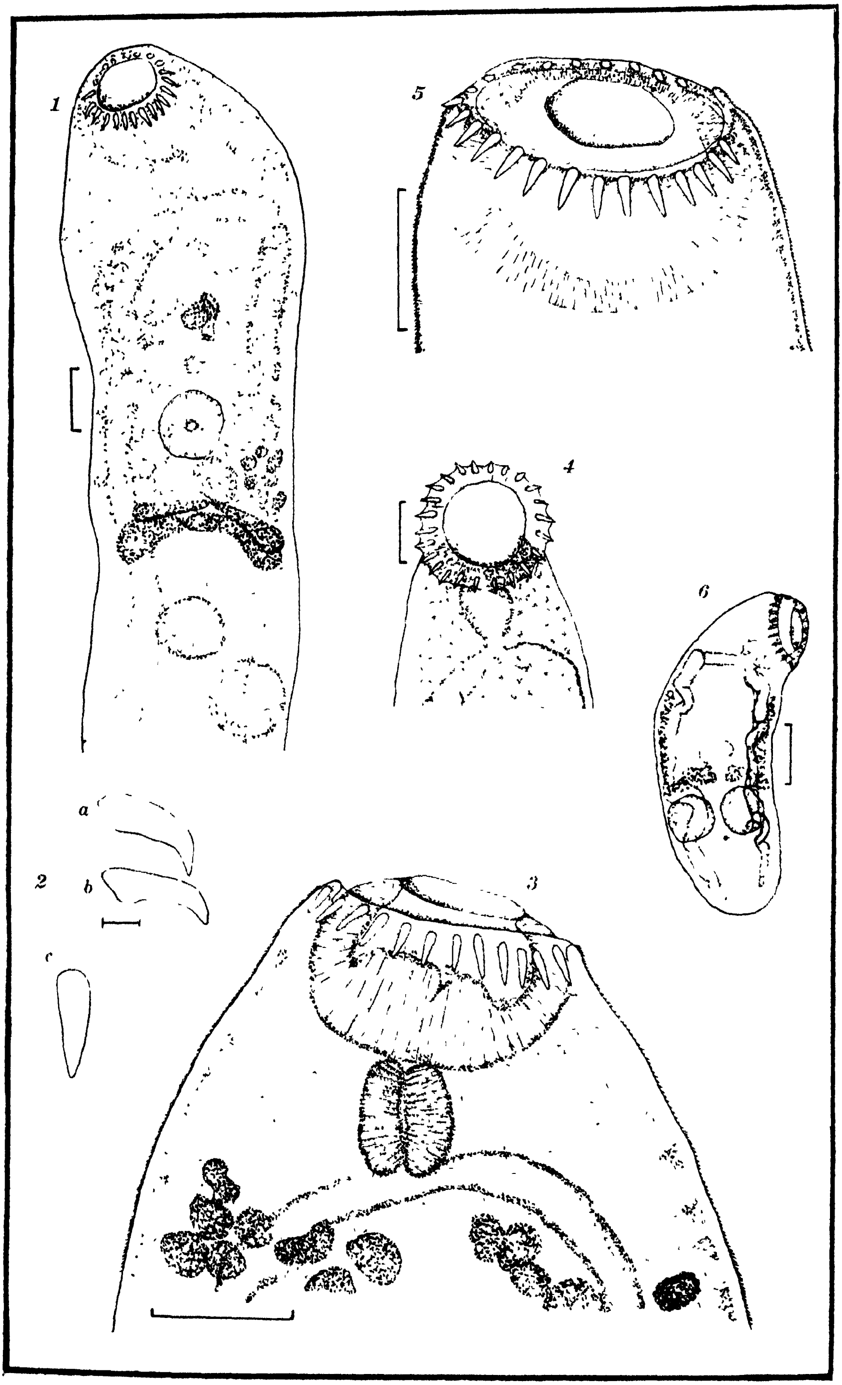
2. *a* and *b*, lateral views of spines from oral circle. *c*, ventral view of a single spine.

3. Detailed study of oral region.

4. Oral crown fully extended and sharply marked off from remainder of body.

5. Oral region of greatly elongated specimen.

6. A very young specimen showing lateral position of testes before the uterus contains any eggs.



ALLACANTHOCHASMUS VARIUS, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 8.

NOTES ON WEST INDIAN MILLIPEDS.

By Ralph V. Chamberlin,

Of the Museum of Comparative Zoology, Cambridge, Massachusetts.

The descriptions and notes embraced in this article are based chiefly upon material in the collections of the United States National Museum. Occasion is taken to describe also some new forms in the collection of the Museum of Comparative Zoology in Cambridge, Massachusetts, and to illustrate several previously known species. The characters of the male of Nannolene are made known for the first time, the genus proving to be a member of the Cambalidae proper.

Suborder GLOMERIDESMOIDEA.

Family GLOMERIDESMIDAE.

Genus GLOMERIDESMUS Gervais.

GLOMERIDESMUS CONCOLOR Chamberlin.

Glomeridesmus concolor Chamberlin, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 172.

Locality.—Porto Rico: El Yunque, 2,800 feet (C. W. Richmond, February 26, 1900).

The specimen taken at this place is referable with but litle doubt to this species, the types of which were taken in Haiti at Jacmel by Dr. W. M. Mann.

Suborder STEMMIULOIDEA.

Family STEMMIULIDAE.

Genus PROSTEMMIULUS Silvestri.

PROSTEMMIULUS COMPRESSUS (Karsch).

Stemmiulus compressus Karsch, Zeit. naturwiss., 1881, ser. 3, vol. 6, p. 11.

Localities.—Porto Rico: El Yunque, 2800 feet (C. W. Richmond, February 26, 1900); Adjunctas (L. Stejneger, April 13, 1900).

No. 2431—Proceedings U. S. National Museum, Vol. 61, Art. 10.

PROSTEMMIULUS NESIDES, new species.

Plate 1, figs. 1-3.

Blackish excepting head and first four tergites, which are of a chestnut cast. A median dorsal pale line. Lower part of sides and the venter paler, more brownish. Legs dusky flavous. Antennae black.

Head with the usual two oceli on each side of which the inferior one is minute in comparison with the upper one. Antennae slender; sixth article clavate, about twice as long as thick at distal end.

Collum with one deeper sulcus margining it in front and continuing back to caudal margin; below it and on the inflexed portion of the plate are three finer striae parallel with it, these not visible in lateral view.

Second tergite striate only beneath. Striae on succeeding tergites rising progressively higher and first reaching middorsal region on the ninth segment. Setiferous papillae of last tergite as usual.

Sternites of tenth segment as shown in plate 1, figures 2 and 3.

Length.—14.5 mm.; width, 1.3 mm.

Locality.—Isla de Pinos: Bibijagua. One female (Barbour and Brooks, June, 1918).

Type.—Cat. No. 5030, M. C. Z.

EPINANNOLENOIDEA, new suborder.

Includes the Epinannolenidae, new family, and the Pseudonannolenidae.

EPINANNOLENIDAE, new family.

The genus *Epinannolene* has heretofore been included in a family Nannolenidae on the assumption of a close relationship to *Nannolene*. However, an examination of the copulatory organs of the male of *Nannolene burkei* Bollman, the genotype, shows this genus clearly to be a cambaloid form close to *Dimerogonus* of Attems and related genera having flagella on the anterior gonopods (pl. 1, figs. 4-10). Thus the name Nannolenidae falls as a synonym of Cambalidae or Cambalinae in the strict sense, for which Attems proposed Mastigocambalinae, a name untenable both because not based upon an included genus and also because it includes the type genus of the family which must accordingly be the basis of the name. Attems's name Glyphiocambalinae for the subbranch including genera not having flagella on the anterior gonopods is also not tenable because not based upon an included genus. It may be replaced by Glyphiulinae, new name.

For Epinannolene a new family name must be given; and Epinannolenidae is accordingly here proposed.

Genus EPINANNOLENE Brolemann.

EPINANNOLENE TRINIDADENSIS (Chamberlin).

Plate 2, figs. 1–2.

Nemasoma trinidadensis CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, no. 5, p. 213.

This is a comparatively small form mostly under 18 mm. in length and with most commonly forty-nine segments in the adult, though the number may be several fewer or greater than this. The color varies from light brown to nearly black, with caudal border of segments lighter. The eye consists of two or three transverse series of ocelli, of which the two posterior rows are long, as, for example, 9, 8, 6 and 9, 7, 1. Segments constricted, the sulcus at bottom of constriction marked with imperfect punctae. The gonopods of the male (type) as shown in plate 2, figures 1 and 2.

Localities.—Trinidad: Guacharo Cave and Port of Spain. Additional specimens have been examined from these localities.

Porto Rico: San Juan. November, 1899. In the United States National Museum are some female specimens from this locality which are referred to the species with some doubt, though presenting no differences that were detected.

Suborder SPIROSTREPTOIDEA.

Family SPIROSTREPTIDAE.

Genus ORTHOPORUS Silvestri.

ORTHOPRUS SCULPTURATUS (Karsch).

Spirostreptus sculpturatus KARSCH, Zeits. naturwiss., 1881, ser. 3, vol. 6, p. 39.

Locality.—Porto Rico: Lares, several specimens (A. Busck, January 25, 1899).

Suborder SPIROBOLOIDEA.

Genus NESOBOLUS Chamberlin.

NESOBOLUS TOROANUS Chamberlin.

Plate 2, figs. 3–4.

Nesobolus toroanus CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 204.

Locality.—Cuba: Mount Toro, Nimfilas, Ramona el Mono, San Felipe, Los Hondones, Belona.

The figures were made from the type.

NESOBOLUS YATERUS, new species.

Plate 2, figs. 5–10.

This species very much resembles *N. toroanus* Chamberlin in its general coloration and structure. The most obvious difference in coloration is that in the present species the legs are yellowish whereas in all the adults of *toroanus* examined they are distinctly ferruginous.

The markings of the somites in general the same, the suture being deeply impressed throughout on the typical tergites; but the suture of the second segment is absent or weakly developed only on the sides. On the contrary, in *toroanus* the suture of the segment is distinct throughout.

Processes of third, fourth, and fifth legs especially prominent, much as in *toroanus* (see pl. 2, figs. 7, 8).

The species may be distinguished by the form of the minor prong of the posterior gonopods. In *toroanus* this is abruptly bent ventrad near its middle and then a little caudad at its tip (pl. 2, fig. 4). On the contrary, in *yaterus* this prong is but weakly evenly curved as shown in plate 2, figure 6. The form of the anterior gonopods is shown in plate 2, figure 5.

Number of segments, 46–48.

Length, up to near 35 mm.; width, 3 mm.

Locality.—Cuba: Oriente Province, Yateras, Bella Vinta (May 4, 1907) (Type locality), and Jaguey (April 20, 1907). W. R. Maxon collection.

Type.—Cat. No. 858, U.S.N.M.

NESOBOLUS LIBANONUS, new species.

Plate 2, fig. 11; plate 3, figs. 1–5.

Resembling *toroanus* but the legs pale yellow, not ferruginous. The type differs from those of the other two known species in having the process of the third joint of the fifth legs of male much smaller than those of fourth leg and almost obsolete (see pl. 3, figs. 1–5). The minor prong of the posterior gonopod is bent more than in yaterus but obviously less than in *toroanus* (see pl. 2, fig. 11). The minor prong at its end is in contact, or nearly so, instead of being well separated as it is in *yaterus*, as shown in the figure.

Anterior gonopods essentially as in *yaterus*.

Number of segments, 46.

Thickness, 2.5 mm.

Locality.—Cuba: Alto de la Union, Mount Libano. May 18, 1913 (C. T. Ramsden).

Type.—Cat. No. 5035, M. C. Z.

CUBOCRICUS, new genus.

Proposed for a group of species of large size that differ from *Rhinocricus* in having the telopodite of each posterior gonopod simple, and slenderly acuminate, with no trace of branching or bifurcation. Sensory cones of antennae numerous. Anterior legs of male with tarsal pads or thickenings.

Genotype.—*Cubocricus suprenans* (Chamberlin).

CUBOCRICUS SUPRENANS (Chamberlin).

Plate 3, figs. 6–9.

Rhinocricus suprenans CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 193.

This is the largest of the known West Indian spiroboloids. It is superficially recognizable in having each segment with a posterior border of ferruginous color and the legs light olive, lighter than body. Surface of segments smooth, the sulcus along segmental suture weak; no distinct secondary sulci. Collum weakly notched behind above lower end. In the male distinct tarsal pads are present only on the legs of the anterior region (pl. 3, fig. 9). Gonopods of male as figured (pl. 3, figs. 7–8). Number of segments, typically 46 or 47. The maximum specimen studied has a diameter of 18 mm.

Locality.—Cuba: Baracoa.

Additional specimens from this locality are in the United States National Museum collection. They were secured by Palmer and Riley, January 30, 1902.

CUBOCRICUS DUVERNOYI (Karsch).

Spirobolus (*Rhinocricus*) *duvernoyi* KARSCH, Zeits. naturwiss., 1881, ser. 3, vol. 6, p. 77.

Contrasting in color with the preceding species in that the caudal border of segment is of a darker color—typically deep olive—than the rest of the segment instead of lighter and ferruginous; also in the much darker olive color of the legs, these not lighter than body. The tergites are ordinarily marked on dorsum with numerous longitudinal furrows across caudal part and commonly show three encircling furrows, one along suture and one on each side of this, these commonly well marked with the anterior one often deepest. Male with tarsal pads on all legs except those of most caudal pairs. Gonopods very similar to those of *suprenans*. Number of segments, 49–53, 49 or 50 being most common. Maximum diameter noted is 15 mm.

Localities.—Cuba: Santiago de las Vegas; Guantanamo; Pinar del Rio; Guanajay (in a cave, May 5, 1900, Palmer and Riley).

Genus RHINOCRICUS Karsch.

The following key, based upon the one by Pocock,[1] will aid in separating the West Indian species of *Rhinocricus* on the more superficial characters.

KEY TO WEST INDIAN SPECIES OF RHINOCRICUS.

a.^{1} Clypeus very deeply excised ---------- **R. excisus** Karsch.

a.^{2} Clypeus lightly and normally excised.

b.^{1} Somites with no second transverse groove in front of the ordinary sulcus (not always strictly true of *arboreus*).

c.^{1} At least some of the anterior somites with posterior border bisinuate above the scobina.

d.^{1} A distinct longitudinal pale stripe along each side of the dorsum; somites forty-two; length under 40 mm. **R. newtonianus** Chamberlin.

d.^{2} No longitudinal pale stripes; the color fuscotestaceous or black; somites forty-six or more.

e.^{1} Pores scarcely above the middle of the side; scobina reaching only to the twelfth somite ---------- **R. parcus** Karsch.

e.^{2} Pores well above the middle of the side; scobina reaching to or beyond the twenty-fourth somite.

f.^{1} Body distinctly annulate with lighter or darker color.

g.^{1} Transverse suture distinct across dorsum throughout. **R. electus** Chamberlin.

g.^{2} Suture obscure or absent dorsally in middle and posterior regions ---------- **R. mediator** Chamberlin.

f.^{2} Color uniform black.

g.^{1} Collum marginate below; scobina reaching twenty-ninth or thirtieth somite; legs and antennae light brown or ferruginous. **R. guadeloupensis** Chamberlin.

g.^{2} Collum not marginate below: scobina reaching twenty-fourth somite; legs and antennae shining black. **R. holomelanus** Pocock.

c.^{2} None of the tergites with posterior border bisinuate.

d.^{1} Anal tergite not surpassing the vales.

e.^{1} Number of somites only forty to forty-four.

f.^{1} Sulcus deep and sharply defined entirely across dorsum; width typically 5 mm. or over ---------- **R. liparus** Chamberlin.

f.^{2} Sulcus weak or obsolete dorsally, disappearing in an obscure furrow; width under 3.5 mm.

g.^{1} Anal valves red; median plate of male gonopods distally rounded with lateral margins below bisinuate. **R. solitarius** Pocock.

g.^{2} Anal valves solid black; median plate of gonopods not of this form.

h.^{1} Collum black with narrow ferruginous borders; number of somites forty; median plate of gonopods, acute distally with evenly concave and diverging sides -- **R. parvior** Chamberlin.

h.^{2} Collum light with black borders; number of somites forty-three or forty-four; median plate of gonopods distad of base in the form of a long, slender, parallel-sided tongue. **R. furcianus** Chamberlin.

---

[1] Journ. Linn. Soc., 1894, vol. 24, p. 486.

e.^{2} Number of somites forty-six or more.

f.^{1} Large species, from 75 to 170 mm. long.

g.^{1} Antennae long, reaching the third segment.
R. domingensis Saussure.

g.^{2} Antennae short, scarcely surpassing the collum.

h.^{1} Length only to near 75 mm.; width under 8 mm.; somites banded along posterior border with flavous or ferruginous.
R. maltzani Pocock.

h.^{2} Length above 125 mm.; width near 13 mm. or more; color black or deep brown without bands of lighter color.
R. haitensis (Gervais).

f.^{2} Smaller species under 60 mm. in length.

g.^{1} Transverse suture strongly marked entirely across dorsum. Somites ferruginous behind suture. (Haiti.)
R. curtior Chamberlin.

g.^{2} Transverse suture weak or obsolete above on most segments.

h.^{1} A series of black transverse bands along the middorsum and on each side of this a longitudinal reddish or ferruginous stripe. (Jamaica) ---------- **R. heteroscopus** Chamberlin.

h.^{2} With no such longitudinal stripes each side of a series of middorsal black marks.

i.^{1} Somites above level of pores uniform dark brown or black, not bordered caudally with lighter band; width 3 mm. or scarcely more ---------- **R. nigrescens** Chamberlin.

i.^{2} Somites dorsally as well as laterally banded with light color along caudal border; width 4.5 mm. or more. (Posterior male gonopods distally strongly bifurcate, the prongs equal in length, the ventral one evenly curved, abruptly expanded at distal end where there are two mucra with convex edge between.) ---------- **R. socius** Chamberlin.

d.^{2} Anal tergite surpassing the valves.

e.^{1} Segments forty to forty-two.

f.^{1} Legs long; antennae reaching the fourth somite.
R. gracilipes Karsch.

f.^{2} Legs short; antennae not reaching to fourth somite.
R. grenadensis Pocock.

e.^{2} Segments fifty or more.

f.^{1} Posterior part of the segments not elevated.
R. arboreus Saussure.

g^1. Legs dark, uniform or nearly so.
R. arboreus arboreus, forma typica.

g.^{2} Tarsi of legs reddish or orange.

h.^{1} Body light gray; usually a series of dorsal red spots; tarsi orange ---------- **R. arboreus gundlachii** Karsch.

h.^{2} Body darker; no dorsal spots; tarsi reddish.
R. arboreus krugii Karsch.

f.^{2} Posterior part of segments elevated.

g.^{1} Caudal process long ---------- **R. macropus** Pocock.

g.^{2} Caudal process short, but little exceeding valves.
R. modestior Silvestri

b.^{2} Somites with a second sulcus in front of the ordinary one.

c.^{1} The posterior transverse sulcus complete dorsally, at least on segments in middle of body.

d.^{1} Anterior sulcus weak and often interrupted, the posterior weaker, anal tergite not surpassing the valves, and not acutely produced; black with brown legs---------------------------**R. leptopus** Pocock.

d.^{2} The two transverse sulci complete and deep on nearly all the segments.

e.^{1} Larger species near 140 mm. or more in length and 13 mm. or more in diameter.

Scobina extending to posterior region of body.

R. thomasianus Chamberlin.

e.^{2} Smaller species near 60 mm. and under in length.

f.^{1} Anterior transverse sulcus arising on each side from the lateral portion of the posterior sulcus considerably below the pore; color black, with on each segment a median dorsal flavous spot and a lateral flavous spot over each pore.

g.^{1} Anal tergite surpassing the valves. (Dominica).

R. leucostigma Pocock.

g.^{2} Anal tergite clearly exceeded by the valves.

R. martiniquensis Chamberlin.

f.^{2} Anterior transverse sulcus arising on each side in front of and on a level with the pore; segments distinctly flavo- or ferrugino-cingulate.

g.^{1} Caudal process considerably surpassing the valves; the area of the segments behind the posterior sulcus flavous.

R. monilicornis Porat.

g.^{2} Caudal process scarcely or not at all surpassing the valves.

h.^{1} Length up to 60 mm. with width 5 mm. or more (somites forty-seven or forty-eight)------------**R. juxtus** Chamberlin.

h.^{2} Length near 35 mm., and width near 3 mm.

i.^{1} Segments narrowly ferrugino-cingulate along caudal borders; median plate of male gonopods with sides straight.

R. consociatus Pocock.

i.^{2} Segments not bordered with ferruginous; median plate of gonopods with sides convex proximally and conspicuously incurved or concave distad of middle.

R. tobagoensis Chamberlin.

c.^{2} The posterior transverse sulcus obsolete dorsally on all or most of the segments.

d.^{1} Anal tergite acutely angled posteriorly.

e.^{1} Transverse sulcus conspicuous laterally; color as in *monilicornis*, flavo-cingulate--------------------------------**R. anguinus** Pocock

e.^{2} Transverse sulcus obsolete, or nearly so, on most segments; upper surface of segments dark, with a flavous spot on each side of the middle line.

f.^{1} Segments forty-eight to fifty-two---------**R. serpentinus** Pocock.

f.^{2} Segments forty to forty-three---------**R. grammostictus** Pocock.

d.^{2} Anal tergite not acutely produced, rounded.

e.^{1} Posterior portion of segments flavo- or ferrugino-cingulate.

f.^{1} Anal tergite clearly surpassing the valves.

R. mimeticus Chamberlin.

f.[2] Anal tergite surpassed by the valves.
  g.[1] Anal segment black; segments distinctly punctulate or striolate ______________________________ **R. vincenti** Pocock.
  g.[2] Anal valves flavous or lurid or ferruginous; segments smooth and polished, at least dorsally.
    h.[1] Each ordinary segment encircled about its middle with a brown or bluish-brown band, the anterior and posterior border ferruginous; anal valves ferruginous. **R. bruesi** Chamberlin.
    h.[2] Each segment flavous on posterior side as far forward as the suture; a black mark in middorsal region, often with the others giving the effect of a median dorsal black stripe; anal valves flavous or lurid ________ **R. cockerelli** Pocock.
e.[2] General color yellow with a nedian dorsal black band and also a black band on each side at level of pores ____ **R. sabulosus** Pocock.

RHINOCRICUS ARBOREUS (Saussure).

Julus arboreus SAUSSURE, Linnaea ent., 1859, vol. 13, p. 331.

Locality.—Culebra (A. Busck, February, 1899).

The specimens are darker than those seen from St. Thomas, but the legs do not have the reddish tarsi present in the following Porto Rican form.

RHINOCRICUS ARBOREUS KRUGII Karsch.

Julus arboreus SAUSSURE, Linnaea ent., 1859, vol. 13, p. 331.
Spirobolus (*Rhinocricus*) *arboreus, var. krugii* KARSCH, Zeits. naturwiss., 1881, ser. 3, vol. 6, p. 9.

Localities.—Porto Rico: Near El Yunque (C. W. Richmond, February 22, 1900); Rio Piedras.

This variety is very close to the typical form as it occurs on St. Thomas, the type locality. I have examined a considerable number of specimens from the latter locality and find them to lack the abruptly lighter, ordinarily reddish, tarsi characterizing adults of the Porto Rican form. The difference in the depth of coloration of the body pointed out by Karsch is not so constant. Mr. R. Cotton reports this form as feeding on the purple scale (*L. beeki*) of citrus trees.

RHINOCRICUS ARBOREUS GUNDLACHII Karsch.

Spirobolus (*Rhinocricus*) *gundlachii* KARSCH, Zeits. naturwiss., 1881, ser. 3, vol. 6, p. 9.)

Localities.—Porto Rico: Near Pueblo Viejo (L. Stejneger and C. W. Richmond, February, 1899); El Yunque, on Catalina plant (February 2, 1900, L. Stejneger); Manati (December, 1899); Vega Baja (December, 1899).

In this light grey form the tarsi are quite uniformly orange-colored and there is typically a middorsal series of red spots. The dorsal spots are darker, brown or blackish, instead of reddish, and may be wholly absent.

Genus CUBOBOLUS Chamberlin.

This genus embraces a group of mostly small spiroboloids closely related to *Rhinocricus*, into which it may have to be withdrawn. It is retained, for the present, for the West Indian *Rhinocricus-like* species that lack scobina. A new species is here added to the group. The following key will aid in placing the species:

a.[1] Body with a longitudinal light band along each side and one each side of middorsal line ---------- **C. cinchonanus**, new species.

a.[2] Body with no longitudinal light bands.

b.[1] Transverse sulcus of segments complete and distinct dorsally.

c.[1] Anal tergite acutely angled; black, with a median dorsal series of pale spots ---------- **C. ramagei** (Pocock).

c.[2] Anal tergite rounded behind; body with no median dorsal series of pale spots.

d.[1] Area of segments behind the transverse sulcus widely and completely flavous ---------- **C. mandevillei** (Pocock).

d.[2] Area of segments behind the transverse sulcus dark chestnut. **C. beliganus** Chamberlin.

b.[2] Transverse sulcus of segments obsolete or very weak dorsally.

c.[1] Collum with border weakly or obscurely marginate.

d.[1] Segments 39 or 40; length under 30 mm. (color black excepting a fine pale caudal border) ---------- **C. townsendi** Pocock.

d.[2] Segments 44 to 47; length 45 mm. or more.

e.[1] Second tergite flattened below; light band of segments extending to suture ---------- **C. gossei** (Pocock).

e.[2] Second tergite not flattened below; light band very narrow dorsally, much short of attaining the suture. **C. rarior** (Chamberlin).

CUBOBOLUS CINCHONANUS, new species.

Plate 3, figs. 10–11.

A small form characterized by a peculiar color pattern. Along the dorsum a light band traversed on the median line by a series of black marks consisting of a T-shaped figure with a dot above it on each segment, the longitudinal piece of the T thick. A narrow pale stripe along each at the middle of the height. Legs yellow. Antennae brown.

Collum with a margining sulcus below, this curving upward a short distance at its anterior end where it is deepest. Surpassed by the second tergite below.

Segmental suture absent or traceable only near pore. Segments smooth, weakly constricted about middle. Segments striate beneath and on the anterior and median segments with a series of short, curved, impressed lines in the constricting furrow below level of pore on each side. No scobina present.

Anal tergite exceeded by the valves, rounded behind. Anal valves moderately compressed. Anal scale broadly triangular, apically rounded.

Gonopods as represented in plate 3, figures 10 and 11.

Number of segments, 39.

Length.—About 27 mm., width 2 mm.

Locality.—Jamaica: Cinchona. One male. (C. T. Brues, January, 1912.)

Type.—Cat. No. 5031, M. C. Z.

Genus MICROSPIROBOLUS Silvestri.

This South American and West Indian genus is likely to prove heterogenous, though our present knowledge is too incomplete to furnish grounds for division. The West Indian species now known to belong to this group are *M. marmoratus* Silvestri, *M. insularis* Silvestri, *M. belonanus* Chamberlin, *M. fontis*, Chamberlin, *M. lineatus* Chamberlin, and the three new species described below.

MICROSPIROBOLUS FONTIS Chamberlin.

Plate 4, figs. 1, 2.

Microspirobolus fontis CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 208.

Locality.—Cuba: San Diego de los Baños.

The figures are made from the type.

MICROSPIROBOLUS BELONANUS Chamberlin.

Plate 4, figs. 3, 4.

Microspirobolus belonanus CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 207.

Locality.—Cuba: Belona Oriente.

MICROSPIROBOLUS LINEATUS Chamberlin.

Plate 4, figs. 5, 6.

Microspirobolus lineatus CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 209.

Locality.—Haiti: Diquini.

MICROSPIROBOLUS EREMUS, new species.

Plate 4, figs. 7–10.

Deep brown or black, a narrow pale ferruginous caudal border on each segment and the covered portion of prozonite also paler, the pale bands sometimes expanding in ventral region adjacent to legs. In the lighter colored specimens the repugnatorial glands show as a lateral series of black spots, particularly in the posterior half of the body. Legs ferruginous or brick red.

Head smooth. Labral pores 4+4. Eyes widely separated, subcircular; ocelli in four or five transverse series in which the ocelli are but weakly convex and often indistinct.

Collum narrowly rounded beneath on each side; deeply margined below and up the anterior border to level of eye.

Segments striate only beneath, elsewhere wholly smooth. The segmental suture sharply impressed throughout, widely but weakly angled opposite the pore which is somewhat less than half-way from the suture to caudal margin.

Anal tergite broadly rounded behind, a little surpassing the valves. Anal valves wholly smooth, not compressed or margined. Anal scale broadly triangular.

With conspicuous subconical processes on coxae of third to fifth pairs of legs in the male, the coxae of sixth and ninth pairs not produced (see pl. 4, figs. 9, 10).

For gonopods see plate 4, figures 7 and 8. Posterior pair very small.

Number of segments, 44–46.

Locality.—Cuba: Soledad. Ten specimens taken in 1917–18 by Thomas Barbour.

Type.—Cat. No. 5032, M. C. Z.; paratypes, Cat. No. 5033, M. C. Z.

MICROSPIROBOLUS MIMUS, new species.

Plate 5, figs. 4, 5.

Segments typically black or nearly so dorsally but paler, testaceous, caudad of suture below level of pores and especially ventrally, and with a narrow pale caudal border as in *eremus*. Legs ferruginous.

Eyes widely separated, with ocelli in five series; as for example, 8, 7, 7, 4, 3: Clypeal foveolae 3+3 or 4+4.

Collum rounded and margined below as in the *eremus*.

Segmental suture distinct throughout, excised opposite the pore. Segments striate beneath and also with short striae running from suture a little ways caudad part way up the side.

Anal tergite rounded behind, equalling the valves. Anal valves weakly margined and with a few weak longitudinal striae ectad of the margining one. Anal scale broad and short, the caudal angle very obtuse. Processes of coxae of legs of male as usual.

Gonopods as shown in plate 5, figures 4 and 5.

Number of segments, fifty-four.

Length, about 30 mm., width, 2.5 mm.

Locality.—Cuba: San Diego de los Baños. One male. (April 17, 1900, Palmer and Riley.)

Type.—Cat. No. 859, U.S.N.M.

MICROSPIROBOLUS RICHMONDI, new species.

Plate 5, figs. 1–3.

General color greyish black, the color sometimes deeper caudally just in front of the pale edge. A series of light ferruginous spots on each side of the dorsum, these sometimes obscure. Legs and antennae ferruginous.

Eyes widely separated with ocelli in four or five transverse series; e. g., 5, 4, 4, 2, 1. Clypeal foveolae 4+4.

Collum deeply margined below and up to end of eye in front; lower corners rounded, with the intervening margin weakly convex. Segmental sulcus distinctly impressed; on the sides at and below level of pore consisting of a series of united short curved lines with concavity caudad, but not openly angled or curved at level of pore. A series of short striae just caudad of and united with the sulcus, these succeeded below by larger striae reaching from sulcus to caudal margin.

Caudal angle of last tergite rounded, exceeded by the valves. Anal valves smooth, mesal border evenly protruding but not set off by margining sulcus or furrow. Anal scale broad, the caudal margin convex.

Gonopods as shown in plate 5, figures 1–3.

Number of segments, thirty-nine to forty-five.

Length of female, 25 mm.; width, 2.6 mm. Width of male, 2.2 mm.

Locality.—Porto Rico: El Yunque, 2,800 feet. (February 26–27, 1900, C. W. Richmond.)

Type.—Cat. No. 860, U.S.N.M.

Genus SPIROSTROPHUS Saussure and Zehntner.

Myriapodes Madagascar, 1902, p. 150. (As subgenus of *Spirobolus.*)
Glosselus COOK, Proc. U. S. Nat. Mus., 1911, vol. 40, p. 163.
Cairibolus CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 209.

Examination of more ample material shows that the writer previously misinterpreted the posterior gonopods of the species placed under *Cairibolus* and that they are trigoniulids rather than allies of *Microspirobolus.* They conform to the East Indian *Spirostrophus,* as do also the forms described as *Trigoniulus frater*, *remotus*, and *garmani*. This leaves *T. lumbricinus* (Gerstaecker) as the only species of *Trigoniulus sens. str.* known to occur in the West Indies.

Suborder POLYDESMOIDEA.

Family STRONGYLOSOMIDAE.

Genus ORTHOMORPHA Bollman.

ORTHOMORPHA COARCTATA (Saussure).

Polydesmus coarctata SAUSSURE, Mem. Soc. Phys. Genève, 1860, p. 39, fig. 18.

Localities.—Cuba: Isla de Pinos, Bibijagua (June, 1918, T. Barbour and W. S. Brooks); Habana (August 5, 1900, Palmer and Riley); Baracoa (January 30, 1902, Wm. Palmer); Cabañas (June 4, 1900, Palmer and Riley); Yateras, Bella Vista, Oriente Prov. (May 4, 1907, W. R. Maxon); El Guama (Palmer and Riley, March 6, 1900).

Porto Rico: San Juan (November 5, 1899); Vieques (L. Stejneger, March 28, 1900).

Family LEPTODESMIDAE.

Genus AMPHELICTOGON Chamberlin.

AMPHELICTOGON DOLIUS, new species.

The middorsal region dark brown, the keels and a varying area of the contiguous part of dorsum dull yellowish white, the light area on each side commonly broader than the median brown area, the latter sometimes greatly reduced on posterior segment. Keels under lens showing dense area of small darker spots. The collum yellowish over keels and along caudal border and in a small lunate spot at anterior border, or this spot sometimes absent. Prozonites dark brown above, uniformly paler or testaceous below. Anal valves dark brown or blackish, uniform, contrasting with the pale anal scale. The last tergite dark only across base.

Second, third, and fourth keels each with a distinct tooth at the antero-lateral corner. Caudal margin of keels somewhat convex and wholly without teeth. Processes of nineteenth tergite small, rounded; those of eighteenth tergite about equalling those of seventeenth but a little more rounded. Processes of other tergites weak.

Length.—32 mm.; width, 4.5 mm.

Locality.—Cuba: Punta de Judas, 40 miles east of Caibarien (T. Barbour, 1917–18.)

Type.—Cat. No. 5024, M. C. Z.; paratypes Cat, No. 5025, M. C. Z.

In the great relative width of the light areas of keels and adjacent portion of dorsum differing in color from the other known species.

AMPHELICTOGON PINETORUM, new species.

Plate 5, fig. 6.

When in full color the dorsum is chocolate brown to black, with the keels yellowish white, the mesal edge of each light area running from anterior inner end of keel obliquely caudoectad to near middle of caudal edge of keel. Under the lens each keel is seen to be marked with numerous small dark dots. Sides also dark, uniform, the venter light brown to nearly yellow. Last tergite dark, excepting the projecting cauda. Antennae and legs dark red.

The second to fourth keels with a small lateral tooth. None of the keels with tooth or projecting nodules on caudal margin. Processes of keels all short; those of nineteenth small and rounded, much shorter than those of eighteenth which are longer than those of the seventeenth.

Lower branch of gonopods without tooth at point where it narrows into style; the latter proximally with a strong sigmoidal flexure and curled into a circle at tip. Blade of upper or anterior branch bent in a semi-circle, acute, with a single subapical tooth (see pl. 5, fig. 6).

Length.—26-30 mm.; width of male 3 mm., of female 3.5 mm.

Locality.—Isla de Pinos: Bibijagua. (Barbour and Brooks, June, 1918), (Type locality).

Cuba: San Diego de los Baños. (April 23, 1900. Palmer and Riley.)

Type.—M. C. Z. 5,026: paratypes 5,027.

RICODESMUS, new genus.

Closely related to *Chondrodesmus*, but the superior branch of gonopods slender, distally styliform, not sheathing the inferior branch, which is also slender, and suggests that of *Chondrodesmus*. Keels of middle and posterior regions narrower than in the latter genus.

Genotype.—*Ricodesmus stejnegeri*, new species.

RICODESMUS STEJNEGERI, new species.

Plate 5, fig. 7; plate 6, figs. 1, 2.

Chestnut in a band across prozonite and anterior portion of metazonite, the caudal part of metazonite covered by a lighter, sometimes flavous, band that extends also along lateral border of keel, the flavous band commonly broad, embracing most of metatergite. Legs and antennae flavous.

Dorsum of segments convex; smooth, showing neither tubercles nor polygonal areas, and also with no transverse sulcus. All keels narrow, even the anterior ones being longer than broad, while in the posterior ones the anterior portion in front of the pore-body is represented only by a simple ridge or swelling on the side of the tergite. Anterior corners of keels rounded, the posterior curve in general only weakly produced even on posterior tergites.

Sternites without tubercles or processes in male.

Pleural keels present on first nine segments.

Gonopods as shown in plate 6, figures 1 and 2.

Length, to about 25 mm.; width, to 4 mm.

Localities.—Porto Rico: El Yunque. (L. Stejneger; C. W. Richmond 1900), (Type locality); La Munda (November, 1899, G. P. Goll); Lares (A. Busck, 25, January, 1899).

Type.—Cat. No. 861, U.S.N.M.

Family CYCLODESMIDAE.

Genus CYCLODESMUS Humbert and Saussure.

CYCLODESMUS HAITIANUS Chamberlin.

Plate 6, fig. 3.

Cyclodesmus haitianus CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 215

Locality.—Haiti: Diquini and Petionville.

CYCLODESMUS BRUESI Chamberlin.

Plate 6, fig. 6.

Cyclodesmus bruesi CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 215.

Locality.—Jamaica: Liguanea Plain.

CYCLODESMUS PINETORUM, new species.

Plate 6, figs. 4, 5.

With a broad pale band along middorsal region, the sides below it being dusky but with a vertical light mark inclosed on each keel. Usually the dusky color of the sides extends across dorsum in a narrow band along the caudal border of each segment. The usual middorsal dark line showing through in posterior region.

The third keel not expanded below as much as in *C. porcellanus*, being but little broader below than dorsal region of the tergite, nearly as in *C. haitianus.* It is most readily distinguished from the latter species by the form of the fourth keel, which at the lower end is more broadly rounded and lacks the notch on caudal side as shown in figure 4, with which compare plate 6, figure 4. In the form of this keel much more nearly approaching *C. bruesi* of Jamaica. Keels of posterior region not notched on caudal side.

The gonopods of male as shown in plate 6, figure 5.

Length.—13 mm.; width, 4 mm.

Locality.—Isla de Pinos: Bibijagua. Barbour and Brooks, June, 1918. Four specimens.

Type.—Cat. No. 5028, M. C. Z.; paratypes, Cat. No. 5029, M. C. Z.

Most resembles *C. bruesi* Chamberlin, of Jamaica, but differs in form of gonopods as well as in certain details of the keels, as shown in the figures.

Family CRYPTODESMIDAE.

Genus HOMODESMUS Chamberlin.

HOMODESMUS PARVUS Chamberlin.

Homodesmus parvus CHAMBERLIN, Bull. Mus. Comp. Zool., 1918, vol. 62, p. 222.

Locality.—Porto Rico: San Juan (5 Nov., 1899).

A single male taken at this locality agrees fully with the types, which are from Manneville, Haiti.

EXPLANATION OF PLATES.

PLATE 1.

Prostemmiulus nesides, new species.

FIG. 1. Collum and adjacent parts, lateral view. ×33.
2. Anterior sternite of eleventh segment. ×33.
3. Posterior sternite of eleventh segment. ×33.

Nannolene burkei Bollman.

4. Gnathochilarium of male. ×33.
5. Gonopods of male, anteroventral view. ×33.
6. Gonopods of right side, mesal view. ×33.
7. Left posterior gonopod, mesal view, more enlarged.
8. First leg of male. ×33.
9. Sixth leg of male (first joint omitted). ×33.
10. Seventh leg of male. ×33.

PLATE 2.

Epinannolene trinidadensis (Chamberlin).

FIG. 1. Left gonopod of male, subectal view.
2. Distal portion of right gonopod, caudal view.

Nesobolus toroanus Chamberlin.

3. Anterior gonopods, anterior view. ×33.
4. A posterior gonopod. ×33.

Nesobolus yaterus, new species.

FIG. 5. Anterior gonopods, anterior view. X33.
6. A posterior gonopod. X77.
7. Fourth right leg of male. X77.
8. Fifth right leg of male. X77.
9. Sixth right leg of male. X77.
10. Eleventh right leg of male. X77.

Nesobolus libanonus, new species.

11. A posterior gonopod. X77.

PLATE 3.

Nesobolus libanonus, new species.

FIG. 1. Third left leg of male. X77.
2. Fourth right leg of male. X77.
3. Fifth right leg of male. X77.
4. Sixth right leg of male. X77.
5. Seventh right leg of male. X77.

Cubocricus suprenans (Chamberlin).

6. Position of repugnatorial pore with reference to sutures, left side of an anterior segment. X19.5.
7. Anterior gonopods, anterior view. X7.
8. A posterior gonopod. X7.
9. Tarsus of seventh leg of male in outline. X14

Cubobolus cinchonanus, new species.

10. Anterior gonopods, anterior view. X48.
11. A posterior gonopod. X48.

PLATE 4.

Microspirobolus fontis Chamberlin.

FIG. 1. Anterior gonopods, anterior view. X33.
2. A posterior gonopod. X77.

Microspirobolus belonanus Chamberlin

3. Anterior gonopods, anterior view. X33.
4. A posterior gonopod. X77.

Microspirobolus lineatus Chamberlin.

5. Anterior gonopods, anterior view. X33.
6. A posterior gonopod. X77.

Microspirobolus eremus, new species.

7. Anterior gonopods, anterior view. X66.
8. A posterior gonopod. X77.

FIG. 9. Third leg of male. ×48.
10. Seventh leg of male. ×48.

PLATE 5.

Microspirobolus richmondi, new species.

FIG. 1. Posterior gonopod of male. ×77.
2. Anterior gonopods, anterior view. ×33.
3. Anterior gonopods of a smaller paratype. ×33.

Microspirobolus mimus, new species.

4. Anterior gonopods, anterior view. ×33.
5. A posterior gonopod. ×77.

Amphelictogon pinetorum, new species.

6. Ventral view of right gonopod. ×33.

Ricodesmus stejnegeri, new species.

7. Fourteenth and fifteenth left keels in outline. ×19.5.

PLATE 6.

Ricodesmus stejnegeri, new species.

FIG. 1. Mesal view of gonopod of male. ×77.
2. Ventral view of the same. ×77.

Cyclodesmus haitianus Chamberlin.

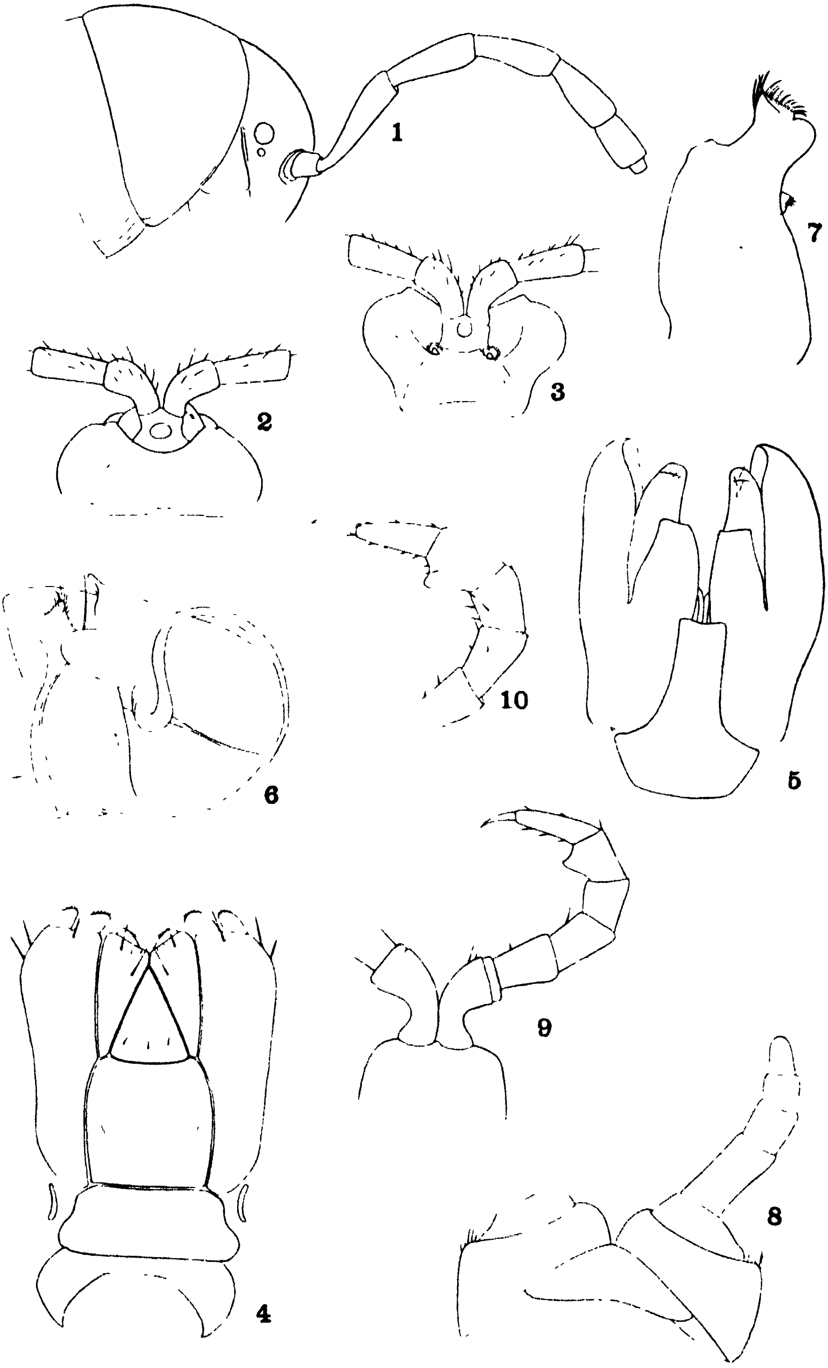
3. Third, fourth, and fifth tergites, view slightly dorsal of lateral.

Cyclodesmus pinetorum, new species.

4. First five tergites, lateral view. ×19.5.
5. Ectal view of a gonopod. ×77.

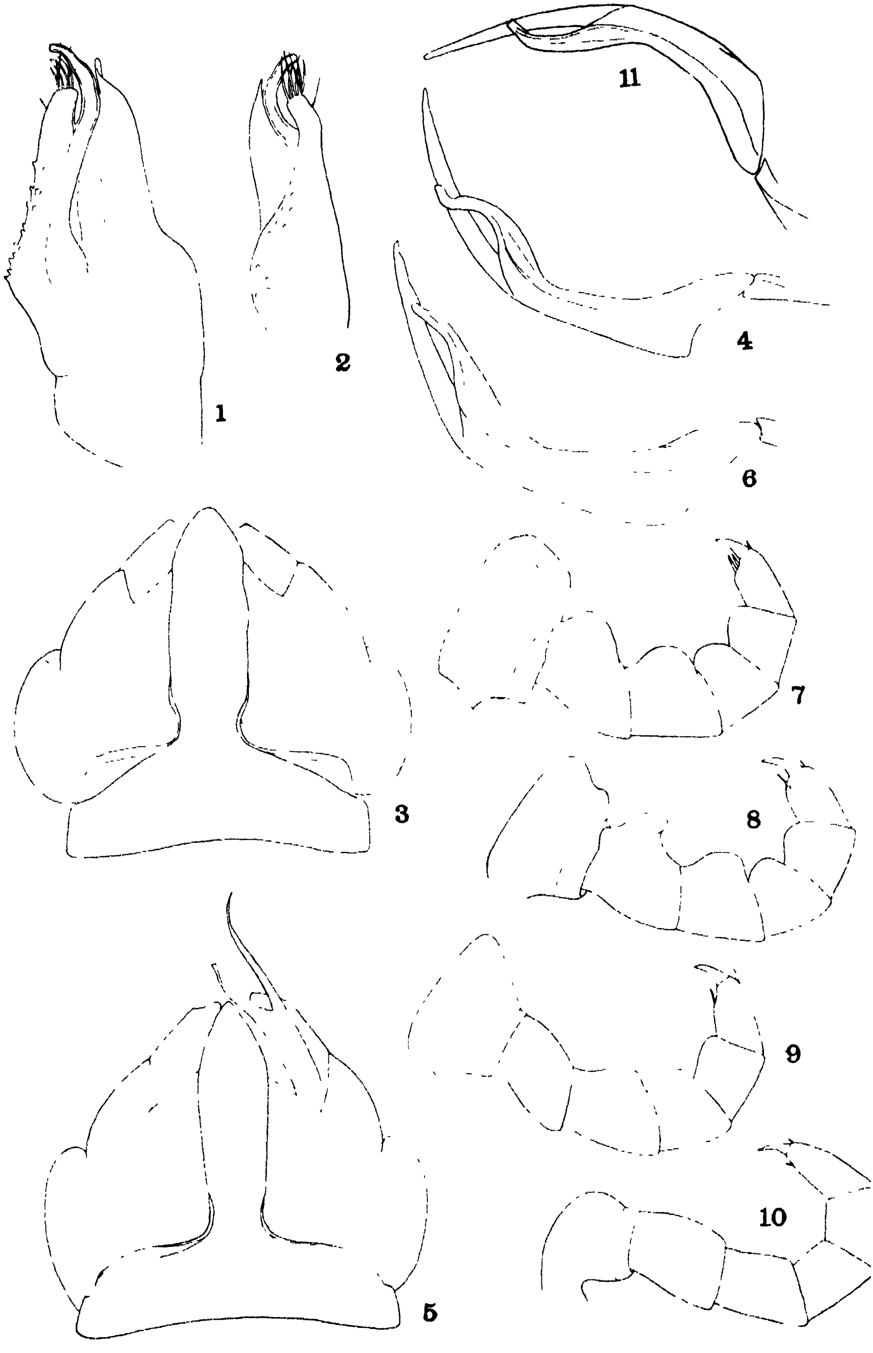
Cyclodesmus brucei Chamberlin.

6. Ectal view of gonopod. ×77.



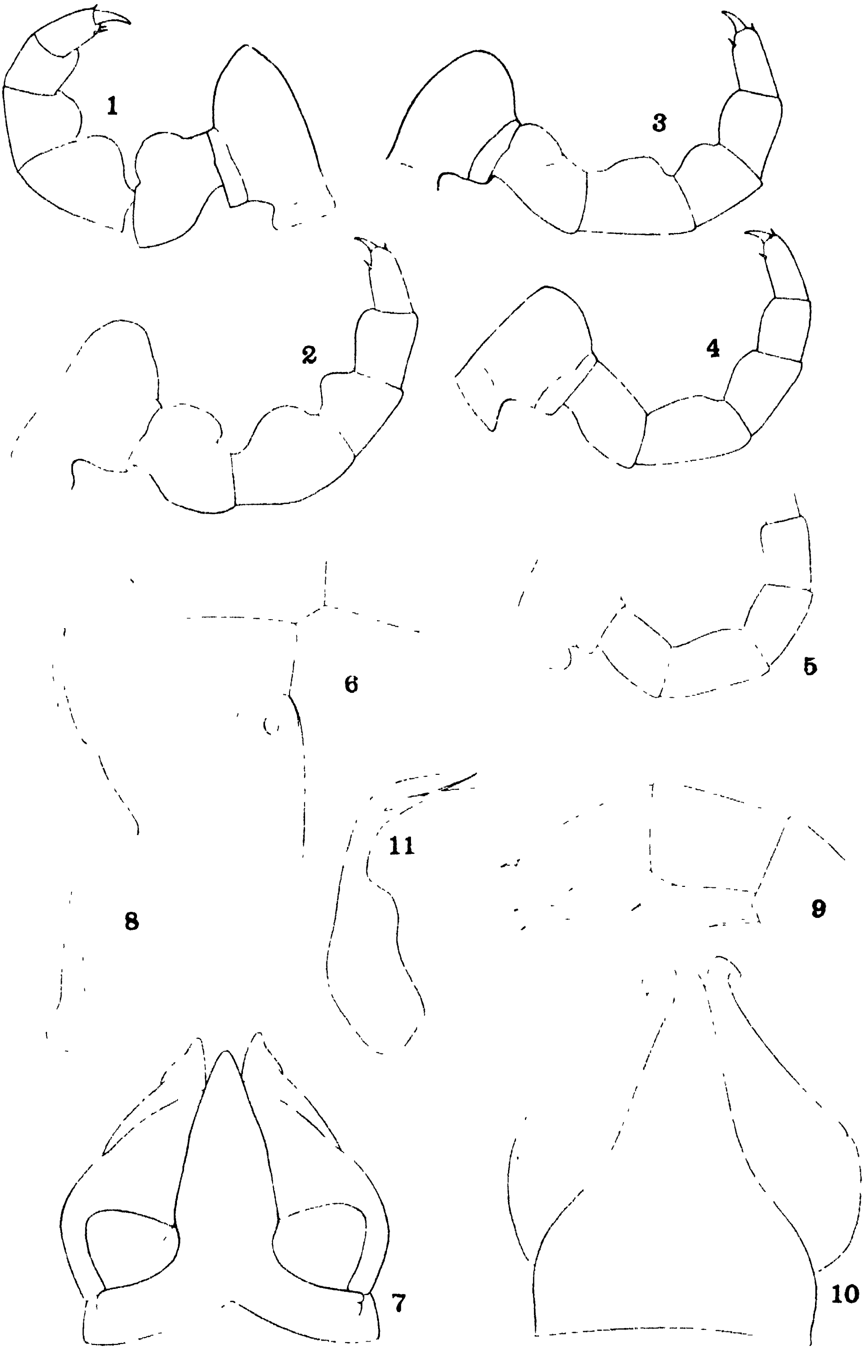
WEST INDIAN MILLIPEDS.

FOR EXPLANATION OF PLATE SEE PAGE 17.



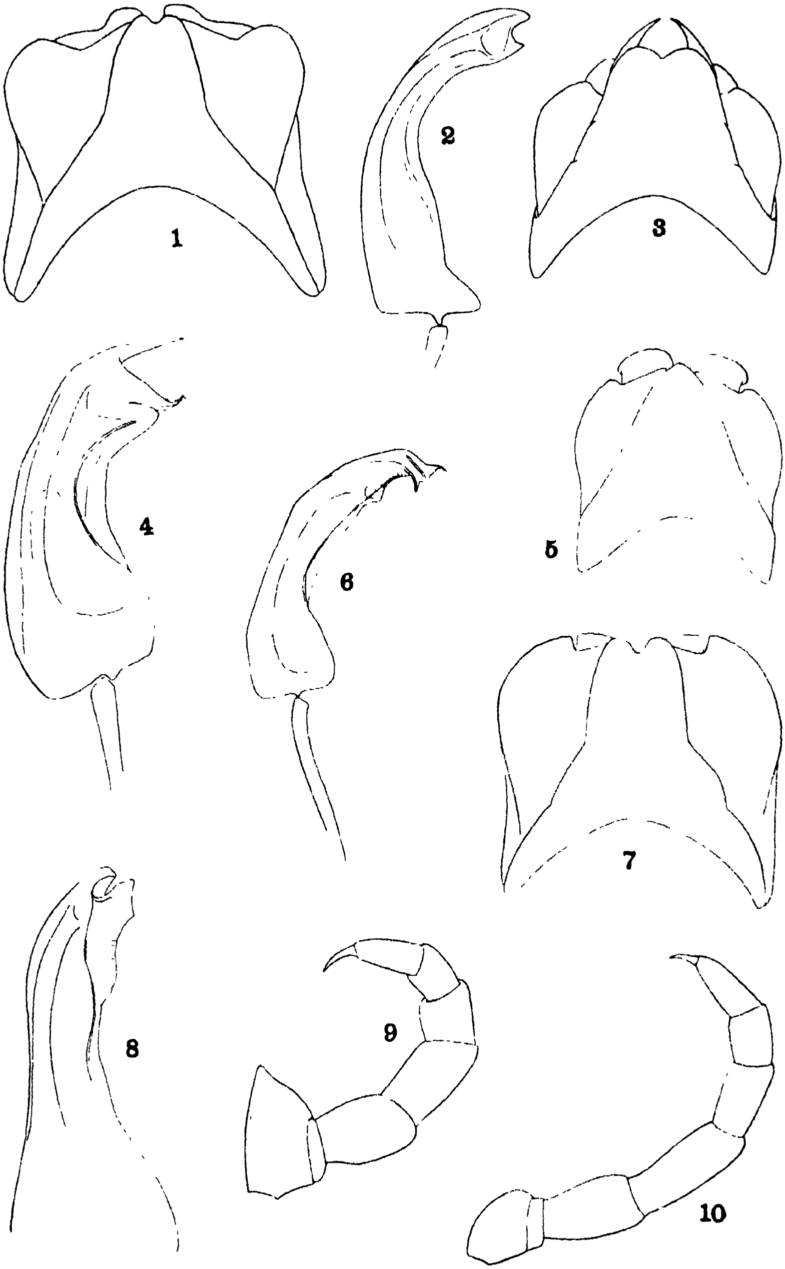
WEST INDIAN MILLIPEDS.

FOR EXPLANATION OF PLATE SEE PAGES 17 AND 18



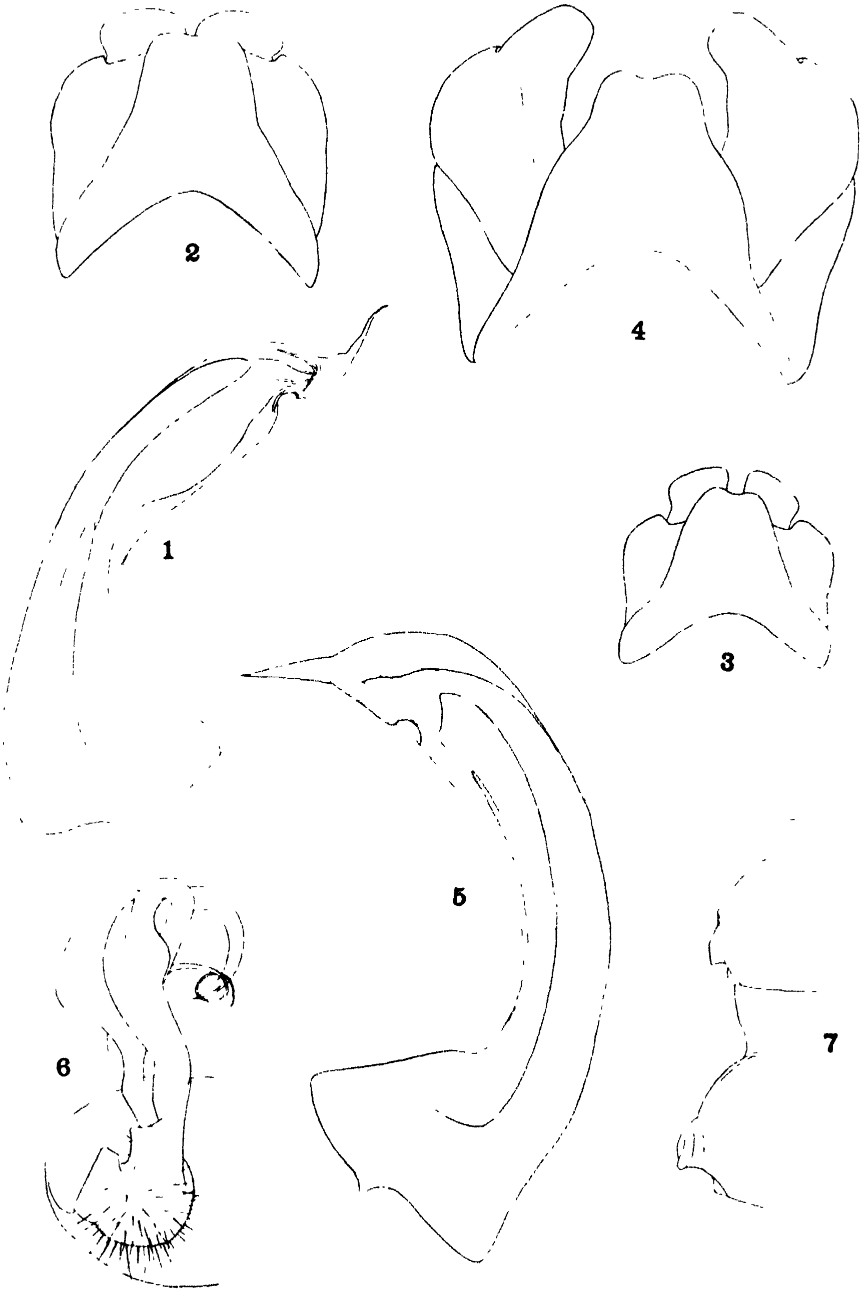
West Indian Millipeds.

For explanation of plate see page 18



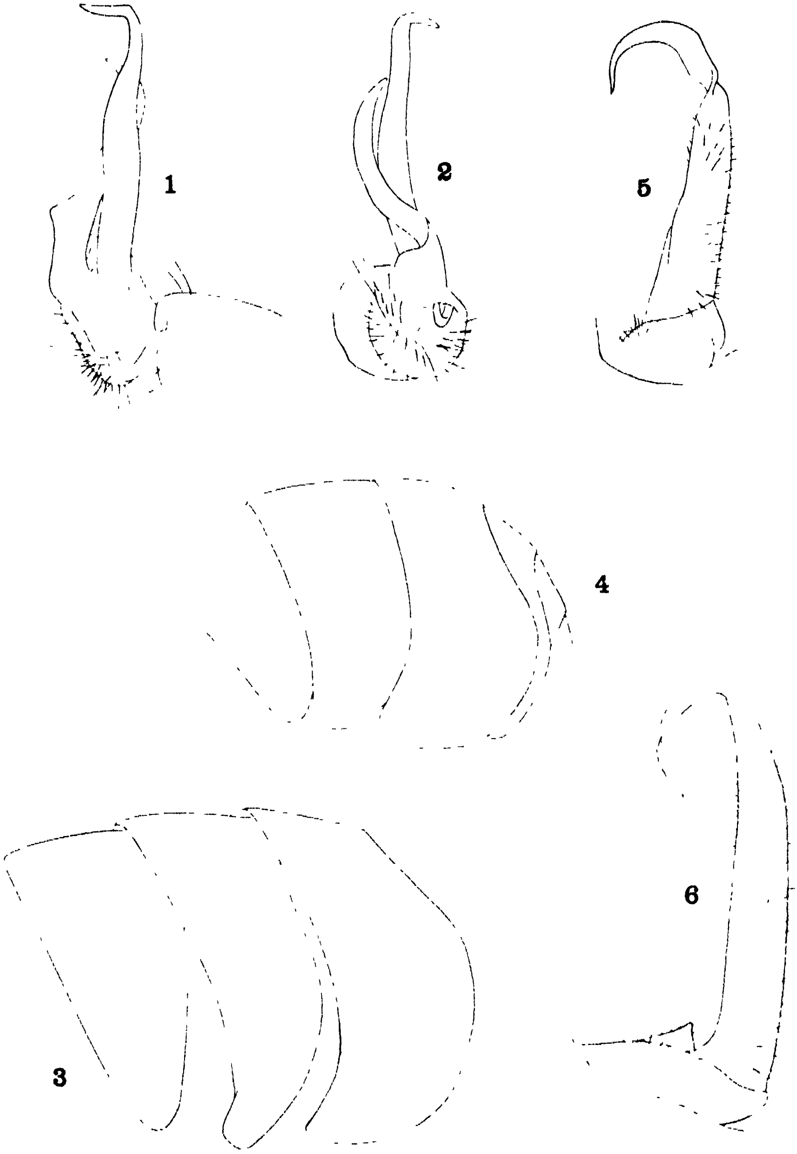
WEST INDIAN MILLIPEDS.

FOR EXPLANATION OF PLATE SEE PAGES 18 AND 19



WEST INDIAN MILLIPEDS.

FOR EXPLANATION OF PLATE SEE PAGE 19



WEST INDIAN MILLIPEDS.

FOR EXPLANATION OF PLATE SEE PAGE 19

PARSEE RELIGIOUS CEREMONIAL OBJECTS IN THE UNITED STATES NATIONAL MUSEUM.[1]

By I. M. Casanowicz,

Assistant Curator, Division of Old World Archeology, United States National Museum.

INTRODUCTION.

THE PARSEES.

The Parsees are the descendants of the ancient Persians, who, at the overthrow of their country by the Arabs in 641 A. D., remained faithful to Zoroastrianism, which was, for centuries previous to the Mohammedan conquest, the state and national religion of Persia. They derive their name of Parsees from the province of Pars or Fars, broadly employed for Persia in general. According to the census of 1911 the number of Parsees in India, including Aden, the Andaman Islands, and Ceylon, the Straits Settlements, China, and Japan, amounted to 100,499, of whom 80,980 belonged to the Bombay Presidency.[2] About 10,000 are scattered in their former homeland of Persia, mainly in Yezd and Kerman, where they are known by the name of Gebers, Guebers, or Gabars, derived by some from the Arabic *Kafir*, infidel.

ZOROASTER (AVESTA, ZARATHUSHTRA; PAHLAVI TEXTS, ZARTUSHT; MODERN PERSIAN, ZARDUSHT).

The religious beliefs and practices of the Parsees are based on the teachings of Zoroaster, the Prophet of the ancient Iranians; that is, those Aryans who at an unknown early date separated from the Aryo-Indians and spread from their old seats on the high plateau north of the Hindu Kush westward into Media and Persia on the great plateau between the plain of the Tigris in the west and the valley of the Indus in the east, the Caspian Sea and the Turanian desert in the north, and the Persian Gulf and the Indian Ocean in the south, surrounded on all sides by high mountain ranges, with a great salt desert in the center.

---

[1] A brief description of part of the collection described in this paper appeared in the American Anthropologist, new series, vol. 5, 1903, pages 71–75, with 2 plates. Since then additions have been made to the collection, and as the article in the American Anthropologist is, moreover, not accessible to the general public, it was deemed feasible to give here a description of the enlarged collection with a fuller exposition of the religious tenets and rites of the Parsees.

[2] James Hastings, Encyclopaedia of Religion and Ethics, vol. 9, p. 641.

There are few authentic data about Zoroaster and his life. Concerning the age in which he lived there is wide diversity. Greek writers assigned him dates ranging between 6,500 B. C. and 2,000 B. C., while some native sources and many modern scholars place him in the seventh century B. C. But the fact that by the sixth century B. C. Zoroastrianism had taken root in Persia, where it did not originate, as evidenced from the Behistun inscription of Darius Hystaspis (521–485 B. C.), which show him a worshiper of Ahura-Mazda, the supreme god of the Zoroastrian faith, and that it was well known to the classical authors from the sixth century on as the established religion at least of Media, would seem to accord best with the date of about 1,000 B. C., assumed by some scholars. The question of the birthplace of Zoroaster is also a subject of dispute, but western Iran, probably Atropatene, the mountainous district of ancient Media, corresponding nearly to the modern province of Azerbaijan in Persia, is commonly believed to be the region in which he arose. Tradition is quite in accord that Bactria in Eastern Iran, about the modern district of Balkh in Afghanistan, was the stage of Zoroaster's life and work.

Legend made of Zoroaster, as of other great religious teachers, a glorified and supernatural man. He was born in a miraculous way by immaculate conception, his soul having been kept in the sacred Haoma plant, till God's glory had purified his mother's body. At his birth all creation laughed with joy, while the evil demons fled aghast. When grown he was conducted by an archangel into the presence of God and in glory unutterable received divine revelations. After seven visions he was tempted by Angra-Mainyu (Ahriman), the Evil One, who, foreseeing the discomfiture he and his creatures were to suffer at Zoroaster's hands, first sent demon emissaries to kill him, but Zoroaster routed him by reciting the confession of faith, not to speak of rocks as big as houses that he had ready to pelt the devils with, defiantly declaring his purpose to destroy the fiends' creation. Angra-Mainyu thereupon offered him vast possessions and earthly dominion if he renounced the good religion (*daena*). But Zoroaster rejects the offer and declares that he will put the devils to flight with the apparatus of worship and the holy words. Thereupon the whole host, with cries of terror, precipitately flee down to the world of darkness.

What with some plausibility can be gathered from Zoroaster's own words, and the earliest parts of the Zoroastrian scriptures, is that he was a man of good birth, belonging to the noble family of Spitama, and pure nature, who arose as a prophet and reformer of the old religion of the Iranians. At first his preaching met with much opposition and for years was without effect. But at last he succeeded in winning the king Hystaspes (Vishtap, Gushtap, not to be confounded with Hystaspes, the father of Darius) for his teaching, and with his aid converted by force in religious warfare the whole kingdom. At the age of 77 the aged warrior-prophet fell in one of these religious wars, while fighting against the fierce Turanians—says tradition. (Plate 1.)

THE SACRED LITERATURE OF THE PARSEES.

The oldest and original Zoroastrian literature goes under the general name of Avesta or Zend Avesta, which is rendered, "text" or "law" and commentary. It consists of the following divisions:

1. *Yasna*, the chief liturgical work and the oldest and most sacred part of the Avesta, including as it does the *Gathas*, hymns or psalms composed in an older dialect, some of which may have been composed by Zoroaster himself.
2. *Visparad*, containing minor litanies, invocations to the various chiefs of the spiritual and terrestrial creation.
3. *Yashts*, invocations and hymns to the ancient Iranian divinities and heroes.
4. *Khorda Avesta*, or Little Avesta, comprising minor liturgical texts, as the *Nyaishes* and *Gahs*, or the five daily prayers, the *Afringans*, or benedictions, etc., a kind of extract from the Avesta for laymen.
5. *Vendidad*, a code of religious and civil laws and precepts, a kind of Zoroastrian Pentateuch.[3]

Besides the Avesta scriptures, the language of which is akin to Sanskrit, the Parsee religious literature includes many works of a later date written in other languages, chiefly in Pahlavi. Among these are the Dinkard, the Bundahish, the historical account of the reformer-king Ardeshir, the vision of Arda Viraf in his journey through heaven and hell, a crude forerunner of Dante, and his Divina Commedia, etc.

ZOROASTRIAN THEOLOGY.

The supreme figure in Zoroastrianism is Ormuzd (*Ahura-Mazda*, "Wise Spirit," properly "Lord Wisdom"), the all-wise Lord, the God, who made heaven and earth and all that is therein, who governs everything with wisdom, righteousness, and goodness. Associated with him in the government of the world as his ministers are the Amshaspands (*Amesha Spentas*, "Immortal Holy Ones"): 1, Vohu Mano, good mind (the good principle, the idea of good that works in man, inclining him to what is good); 2, Asha, right (as conformity to the moral law and order); 3, Kshathra, the wished-for kingdom (the Kingdom of God); 4, Armaiti, devotion (humble piety, reverence for the Divine); 5, Haurvatat, welfare or perfection; and 6, Amertat, immortality. With these six, to make up the sacred seven, Sraosha, the genius of obedience, of "faithful hearing," is sometimes joined. They were at first mere attributes of God, or personified qualities and ideals of human character in the likeness of God; later certain specified parts of the world were put under their care; they were also assigned to different days and months, and each has a peculiar flower and color.

---

[3] The present Avesta, which equals perhaps one-tenth of the Bible in extent, is believed to be but a small remnant of the original Zoroastrian sacred literature which was lost during the invasions of Persia by Alexander the Great (330 B. C.) and the Arabs (641 A. D.). According to the Arabian chronicler Tabari (died 923 A. D.) the Persian sacred scriptures were inscribed on 12,000 cowhides, and Hermippus, a Greek philosopher of the third century B. C., credits Zoroaster with the composition of 2,000,000 verses.

Besides the Amshaspands, who are termed the "children" of Ormuzd, or may be designated as archangels, the Avesta mentions some minor spiritual beings of the celestial hierarchy, such as the *Yazatas* (modern *Izads*), "worshipful or holy ones," ordinary angels; the *Fravashis*, protecting spirits, who help men in battle and accompany souls to the next world, and some mere abstractions, as *Arshtat*, watchfulness; *Parendi*, riches; *Ashi*, rectitude, etc.

Over against the realm of law and righteousness (*asha*), ruled by Ormuzd and his beneficent ministering spirits, is the sphere of the Lie (druj) and wickedness, dominated by Ahriman (*Angra-Mainyu*, "enemy spirit") at the head of the *daevas*, a body of malevolent and harmful powers. The relation of the opposing powers is variously represented in the different parts of the Zoroastrian scriptures. In the earlier Avesta (the *Gathas*) two primeval principles or causes of light and darkness, of life and death, of good and evil, personified in Spenta-Mainyu, the Holy Spirit of Ahura-Mazda, and Angra-Mainyu, respectively, are assumed, both being subordinate to and united in Ahura-Mazda. As they met they produced life and unlife, determining how at last there should be for the wicked the worst state, and for the righteous the "best mind." Zoroaster is made to say: "In the beginning there was a pair of twins, two spirits, each of a peculiar activity. These are the good and the base in thought, word, and deed. Choose one of these two spirits. Be good, not base. When the two spirits came together at the first to make life and death (not life) and to determine how the world at the last shall be for the wicked the worst life, for the holy the best mental state." In the younger Avesta (especially in the Bundahish) the distinction between the Holy Spirit and God is not preserved, both being identified, so that the opposition thenceforth stands between Ahriman and

Ormuzd, and the conflict between them is extended from the moral sphere—the antithesis of good and evil as a fact in human life—to the physical realm. The ethical dualism hardened into a theological dualism. Over against Ormuzd stands Ahriman as an evil being of supernatural power at the head of the host of malevolent spirits, the cause of all that is evil and noxious in the world. Each of the amshaspands has for an opponent some archfiend (Akemmano, Andra, Saurva, Taro-Maiti, Tauru, Zairirica, and Aeshma (=Asmodeus, Tobit iii, 8; vi, 15). Below these stand the daevas, drujes, pairikas (peris), yatus, etc. Unceasing warfare goes on between these opposite powers. Ormuzd makes; Ahriman mars. The one dwells in endless light, the other in eternal darkness. To Ahriman are attributed the creation of all evil things. He created the killing cold of winter and the intemperate heat; serpents, locusts, ants, rapine, and lust; magic and witchcraft; pride, doubt, and unbelief; evil spirits, demons, and men of devilish character, beasts of prey and noxious vermin; floods and droughts; and the nine hundred and ninety-nine diseases the flesh is heir to are Ahriman's inventions.

The dualism implied in the Zoroastrian doctrine is saved from being a dyo-theism in so far as Ahriman is never the equal of Ormuzd. Ahriman is neither omniscent nor almighty. He possesses only "backward knowledge"; he can not foresee. Hence, he is always too late in his machinations. Moreover, Ormuzd's limitation of power is merely temporary. Ahriman is coeval with Ormuzd but not coeternal. His doom is fixed. At the last judgment his creatures will perish and he himself will be banished from the regenerated earth.[4]

The Parsees protest against the imputation of dualism to their theological system. The primeval principles of good and evil (Vohumano and Akemmano, or Spenta-Mainyu and Angra-Mainyu), the Parsees claim, were, though opposed to each other, united in every existing being, even in Ahura-Mazda himself, and by their union produced the world of material things and of spiritual existences, while the Dastoor (high priest) Rastamji declares: "By angra-mainyu nothing is meant but man's evil spirit or thought. Man receives from Ahura-Mazda the gifts of superior powers, abuses them, and by abusing causes all moral and physical disturbances in himself and in the condition of the world he lives in."[5] There is no question that the modern Parsees are monotheists.

---

[4] "The dualism of Zoroastrianism is an attempt to account for the evil of the present world, physical as well as moral, upon the premises of an ethical theism which can not admit that God is the author of any kind of evil. But because God is almighty as well as perfectly good, it can as little admit that evil, even in hell, is a permanent factor in the universe. The Zoroastrian theologians were concerned with the solution of the ethical problem rather than with the remoter problem which their solution raised. The evil spirit appears on the scene like a *diabolus ex machina*; whether he was eternal they do not seem to have asked, nor would they probably have been much disturbed if their logic had carried them to that conclusion, for since they did not define God metaphysically as the infinite and eternal, but as the good, an eternal devil would not thereby become God." (George Foot Moore, History of Religions, New York, 1913, vol. 1, p. 405.)

ZOROASTRIAN ETHICS.

Zoroastrianism is a religion of struggle and exertion. The cardinal doctrine that the world is a great battle field, on which beneficient powers ceaselessly contend with baleful forces is one of the hinges on which the entire system of Zoroastrian ethics turns. Man is not a passive spectator of this war on whose issue his fortune in time and eternity depends, but a combatant in the thick of the fight. Every man, being treated as a free agent, is by his own choice arrayed under one banner or the other, contending for the good world or the bad.

The moral teachings of Zoroaster are summed up in the triad: good thoughts, good words, good deeds (*humata*, *hukhta*, *hvarshta;* contrast: *dushmata*, *duzhukhta*, *duzhvarshta*). Character lies not in overt act alone, but in the inner springs of conduct. The virtues inculcated may be comprised in general terms as purity alike of body and soul, uprightness, humility, obedience, peaceableness, charity, and benevolence. In addition to these good qualities particular stress is laid upon truthfulness and the faithful keeping of one's word and pledge. "Never break an agreement, O Spitama, neither one that you make with a wicked man nor with an upright man of your own religion; for an agreement holds with both wicked and upright." Next to falsehood and deceit making debts is to be shunned, for that leads to lying and fraud.[6]

The tilling of the soil, the reclamation of waste land by rooting out weeds and thorns, and extending irrigation to make grain and fruits grow is part of practical religion. "Who makes glad the earth? He who plants the most grain, grass, and fruit trees, who brings water to a field where there is none and draws it off where there is too much. . . . How is the Mazdaean religion nourished? By zealously sowing grain. He who sows grain sows good. . . ." The useful animals, especially cattle and dogs, are to be kindly treated, well fed and cared for; cruelty and neglect are grave sins, wanton killing of cattle a crime. On the other hand, the destruction of beasts of prey and noxious vermin is a highly meritorious act.

---

[5] Rastamji Edulji Dastoor Peshotan, Zerathushtra and Zarathushtrianism in the Avesta. Leipzig, 1906, p. 159; compare also Dosabhai Framji Karaka, History of the Parsis, London, vol. 2, p. 187; Martin Haug, Essays on the Sacred Language, Writings, and Religion of the Parsees, Bombay, 1862, p. 258.

[6] Compare Herodotus, book 1, §§ 136 and 138: "Beginning with the age of 5 years to 20, they [the Persians] instruct their sons in three things: to ride, to use the bow, and to speak truth. . . . To tell a lie is considered by them the greatest disgrace; next to that, to be in debt, and this for many reasons, but especially because they think that one who is in debt must of necessity tell lies."

Zoroastrianism did not ignore the body for the elevation of the soul. Physical culture was extolled, and it allowed generally a whole-souled enjoyment of life. Wealth and a large family are signs of virtue. "He who has children is far better than he who is childless; he who has riches is far better than he who has none. . . ."[7]

The Parsees, constituting one of the smallest religious communities in the world, occupy a most prominent place among the several nationalties and religious sects of India, and exemplify in their life the true worth of the teachings of the great Prophet of Iran. They uphold the best of the tenets of the old faith with regard to religious observations. They are distinguished by temperance, purity of life, energy, enterprise, and capacity, and their reputation for benevolence and generosity toward all men is world-wide.

THE HEREAFTER, OR ESCHATOLOGY IN ZOROASTRIAN THEOLOGY.

God's righteous rule involves the idea of judgment and retribution, and Zoroastrian eschatology provides a judgment both for the individual and for the world. The judgment of individuals takes place at death, in which each man's destiny is determined by his religion and by his thoughts, words, and deeds in this life. After death the soul lingers three days and three nights near the body. During these intervening days the soul of the pious tastes "as much of felicity and joy as the entire living world can taste," and the soul of the wicked tastes "as much of misery as the entire living world can taste." On the fourth day at dawn the soul sets out on its journey to the place of judgment at the chinvat bridge. To the righteous comes a perfumed breeze wafted as it were from the south. while the wicked is struck by a cold blast as out of the demonic north, laden with foul stench. At the bridge Mithra, Sraosha, and Rashnu sit in judgment.[8] Rashnu weighs the merits and demerits of the departed on an "undeceiving" golden scale, and his fate is decided according to the result of the weighing, whether the good works or the bad ones tipped the scales. Thereupon the soul has to cross the chinvat bridge, which is spanning the abyss of hell. To the good soul it appears to be nine spear-lengths, or even a parasang (between three and four miles) wide, lead by a fair maiden—the embodiment of his good deeds and pious observances, and guided by the good dogs, who keep watch over the bridge. Through the three forecourts of good thoughts, good words, good deeds the soul passes into the "infinite light," or "light eternal" (Garonmana, "house of songs"), the abode of Ahura-Mazda with the archangels and the spirits of the just, where it is regaled with angels' food and set on a richly adorned throne. "Forever and everlasting they remain in all glory with the angels of the spiritual existences eternally."

---

[7] Zarathustrian doctrine is the first serious attempt to conform material interests and duties with the spiritual needs and longings of mankind, and to reconcile the temporal with the eternal, by regarding the former as reflecting and preparing for the latter. The religious root-idea of Zarathushtrism, when first distinctly expressed, which, as history shows, has not remained fruitless, is that the life of the pious is a sacred labor and struggle, constantly directed against the evil and impure in what we are wont to distinguish as the world of nature and that of the spirit, in order that both may at last be thoroughly purified—in short, that every pious man, according to his ability, is a fellow-worker with God." (C. P. Tiele, Elements of the Science of Religion, Edinburgh and London, 1897, vol. 1, p. 192.)

[8] Parallel to Minos, Aeacus, and Rhadamanthus, the three judges of the dead, in Greek mythology.

Very different is the lot of the wicked. A demon lassoes his soul with his evil noose and drags him to the bridge, where Rashnu with his balances detects all his wickedness. His evil ways confront him in a foul hag whose ugliness is the expression of his character. He finds no helper, becomes frightened on the hair-broad bridge and tumbles down into the abyss. Through the vestibules of evil thoughts, evil words, evil deeds he arrives in the "infinite darkness," the "home of the Lie" (*druj*), where the wicked dead surround him, the demons mock him, and Angra-Mainyu bids bring him loathsome and poisonous food. "And until resurrection he must be in hell in much misery and torments of many kinds." If the good deeds are equal to the bad ones he goes to the place called "equilibrium" (*Hamestakan*). The suffering here is slight, being only a change from cold to heat, inclement cold and burdensome heat following one after the other.

But hell is not eternal, and the bliss of souls in heaven and their torments in hell are not the final state of mankind. When the present world age is at an end there will be a great assize and a general judgment for all mankind. According to Zoroastrian cosmic chronology the whole drama of the world will be played out in a cycle of 12,000 years, divided into four periods of 3,000 years each. The first 3,000 years is the period of purely spiritual existences, as models of the future types of things. In the second period Ormuzd creates the material world. In the third Ahriman breaks into the creation of God. This is the age of human history characterized by the conflict between the rival powers of good and evil. At the beginning of the fourth period (anno mundi 9,000) Zoroaster appears, and at its close the great consummation begins. Saoshyant, the Savior, born miraculously of a pure maiden from the seed of Zoroaster which was hidden for thousands of years in the Seistan lake, in which she bathes, will appear, and all the dead will be raised, their bodies being reconstituted of their original materials. The risen dead will be assembled in one place and will know one another; the deeds of all will be manifest. Then the righteous and the wicked will be separated, the former going to heaven, while the latter are cast into hell to be punished in the body for three days, certain monsters of iniquity being subjected to exemplary sufferings. When this is over, the fire will melt the metal in the mountains till it overpours the whole world and makes it pure. To the righteous it will be like warm milk; to the wicked it will be like molten metal. Saoshyant then sacrifices the ox Hadhayous, and of his marrow and the juice of the Haoma is prepared the ambrosia which is given to the righteous as the food of immortality. All men become of one speech. Those who died old are restored to the age of forty, and if young to that of fifteen.[9] Ahriman and his hordes of evil spirits will be conquered and slain, or driven unresisting into outer darkness. Hell itself is purified by the molten metal and added to the earth. And in this enlarged world, where there will be no more ice and no more mountains, which had been created by the evil one, men are to be immortal, and to live forever united with their families and relations, but without further offspring, in pure and peaceful bliss.[10]

THE COLLECTION.

1. *Fire urn.*—Brass, nickel-plated. The Zoroastrian ritual consists mainly in the tending of the sacred fire and in the offering of Haoma. On account of the former part of the worship the Zoroastrians are frequently denominated "fire worshipers." The Parsees reject this imputation with indignation. They pay reverence, not worship, to fire as bearing by reason of its brightness, activity, purity, and incorruptibility the most perfect resemblance to the nature and perfections of the supreme God, and therefore as his most adequate symbol. All the elements, as the pure creatures of Ahura-Mazda, are invested by the Zoroastrians with sanctity, but fire especially was considered as the earthly form of the heavenly light, the eternal, infinite, divine, the first creature of Ahura-Mazda, and in the Avestan scriptures,

---

[9] According to another version, vegetarians are raised young, and the eaters of flesh as of middle age.

[10] Mohammedan eschatology has borrowed much from the Zoroastrian. The conscience of the departed is in the Mohammedan version personated in a male figure in place of the female of Zoroaster's system. "To the good a man with beautiful face comes, elegantly dressed and perfumed, and says: 'Be joyful in that which made thee so; this is the day which was promised thee.' Then the dead person says to him: 'Who art thou, for thy face is perfectly beautiful?' And the man replies: 'I am thy good deeds.' To the wicked a man with a hideous countenance comes, shockingly dressed and of a vile smell, and says: 'Be joyful in that which makes thee miserable, for this is the day which was promised thee.' Then the dead man says: 'Who art thou? Thy face is hideous and brings wickedness.' He says: 'I am thy impure deeds.'" The balance (*mizan*) is held by the angel Gabriel and is so vast in size that its two scales, one of which hangs over paradise and the other over hell, are capacious enough to contain both heaven and earth. The bridge which is laid over hell, and named by the Mohammedans *Cirat* (properly, road, path), is finer than a hair and sharper than the edge of a razor and beset on each side with briars and hooked thorns. The good will pass with wonderful ease and swiftness, like lightning or the wind, Mohammed leading the way, while the wicked will miss their footing and fall down into hell which is gaping beneath them. (T. P. Hugh, Dictionary of Islam, 1885, pp. 79, 80, 543, and 544.) The bridge of separation has also a parallel in the log over which the American Indian has to come to get to the happy hunting grounds. If an Indian has been virtuous (that is, brave) the log lets him over, but otherwise he can not pass over it, but slips into the foul swamp never to emerge.

called his son. "I sacrifice to thee, Fire, son of Ormuzd, and to all fires and all waters and to all plants, for they are all made by God." The Parsee temple (*dar-i-mihr* or *agiaris*) is divided into two parts: (1) the *adaran*, or place of fire, is a small domed room where the fire is kept burning in a metal urn resting on a stone stool (*adasht*), with a metal tray hanging from the dome (*taj*); (2) the *izishu-gah*, a large quadrangular room, divided by small channels (*pavis*), which is used for the celebration of ceremonies. According to the quality of the fire kept within, three grades of temples are distinguished: 1, *Attash-dagdah*, in which the ordinary fire preserved in a fire temple or even in houses and used in sacred ceremonies is kept; it may be touched both by priests and laymen; 2, *Attash-adaran.* The consecration of the fire requires great ceremonies; the utmost care is taken in watching it and keeping it perpetually burning; it may not be touched by any one but by priests; 3, *Attash-bahran*, the highest of all. The consecration of the fire entails heavy expenses and a long series of ritual for a year or more. The sacred fire is constantly watched by priests who have undergone the highest purifications. Its extinction would be regarded by the Parsees as a great calamity. Non-Zoroastrians are excluded from any fire temple.

The fire in the fire temple is purified in the following manner: Over a fire taken from various places of manufacture, to which, if possible, fire caused by lightning is added, a perforated metal tray containing small chips of fragrant sandal-wood is held until the chips are kindled by the heat. After a new fire is in this manner produced from the impure one, the latter is taken away, dispensed, and extinguished. Again, by means of the heat of this first new fire, another bundle of sandal-wood is ignited, and another fire is produced from it, and the first new fire is then taken way, dispersed, and extinguished. Each of the new fires is treated in the same manner until the ninth is reached, which, "being derived from the impure one through seven intermediate fires, more and more distant from the original impurity, represents the fire in its native purity." The fire in the temple is guarded from every kind of pollution; is fed with scrupulously selected wood (the Parsees in Bombay use sandalwood); the priest wears a thick veil, called *padan*, over his nose and mouth that his breath may not fall on the fire, his hands are encased in long gauntlets and the wood is handled with tongs. Five times a day, at the canonical hours (*gahs*), the priest cleans the room, washes the stone stools on which the fire urn rests, and puts fresh wood on the fire. Height, 13¼ inches; diameters, 11½ and 7½ inches.—Bombay, India. (Plate 2, fig. 2, Cat. No. 216051, U.S.N.M.)[11]

---

[11] Fire altars, not necessarily in temples, were erected all over ancient Iran. Early reliefs and coins show the king standing before a fire altar under the open sky. But from the Achaemenian times on there were shrines in which the sacred fire was kept burning as at present.

2. *Fire ladle.*—Brass, nickel-plated. The sacred fire and all that is connected with it must not come into contact with anything that may defile it. A ladle is therefore used for putting wood chips into the fire urn. Length, 13½ inches.—Bombay, India. (Plate 2, fig. 1, Cat. No. 216053, U.S.N.M.)

3. *Fire tongs.*—Brass, nickel-plated. Used for picking up the wood chips of the sacred fire which would be defiled if touched with the hands. Length, 13½ inches.—Bombay, India. (Plate 2, fig. 3, Cat. No. 216052, U.S.N.M.)

4. *Sprigs of the Haoma Plant.*—The Haoma (Sanskrit, *soma*, Pahlavi and Persian, *hom*), also called moon-plant and swallow-wood, of the milkweed family, *Sacrostemma brevistigma* (*Asclepias acida*). To the juice expressed from its stems were attributed inspiring and healing properties, and it played an important part in the ritual and sacrifices of ancient India. It was personified and deified and worshiped as a god by the Hindus. In the Parsee ritual the haoma is one of the offerings made in the service of the *Yasna*, the principal of Zoroastrian liturgy, which is recited or chanted by two priests, known as the Zaoti and Rathvi, before the sacred fire. The twigs of the secred plant are washed and purified while reciting a prayer, then laid aside in a metal box for at least thirteen months and thirteen days before using in the ceremony. Under elaborate ceremonies the twigs are pounded in a mortar, the expressed juice is mixed with milk and holy water and strained. The draft thus obtained concentrates in itself all the virtues of plants, animals, and the waters. It is drunk sacramentally by the priests in the course of the service, and is administered to the dying as a "draft of immortality." The "green haoma" of this world is a type of the "white haoma" (*haoma-i-saphid*) of the gaokorena-tree, the emblem of immortality. In addition to the haoma the pomegranate and the barsom (Avesta, *baresman*) are used in the ceremony. The barsom consists of twigs or sprays of a certain plant or, where these are not obtainable, as in winter, of brass rods, from five to thirty-five, tied in a bundle and held by the priest at a certain point of the sacrifice. Besides the sacred plants the offering comprises small cakes (*drana*), peculiarly marked, goats' milk (*shir*), an egg and melted butter (*ghee*). These are also eaten by the officiating priests in the course of the service.

The true Zoroastrian sacrifice, the Parsees say, is the offering of good thoughts, good words, and good deeds.—Yezd, Persia. (Cat. No. 231789, U.S.N.M.) Gift of A. V. Williams Jackson.

5. *Offering tray.*—Brass, nickel-plated. Used in the service of the *Afringans*, which are prayers from the Khorda-Avesta (see above, p. 3) recited only by priests. They are recited on a carpet spread on the floor on which are placed, either in a metal tray or on plantain

leaves, the choicest fruits and the most fragrant flowers of the season, and glasses filled with fresh milk, pure water, wine, or sherbet. These prayers are recited either with the object of expressing remembrance of the souls of the departed or with that of invoking the help of the protecting spirits. Diameter, 17¾ inches; depth, 1½ inches.—Bombay, India. (Plate 3, Cat. No. 216054, U.S.N.M.)

6. *Offering tray.*—Brass, nickel-plated. Similar to the preceding, No. 5, only smaller in size. Diameter, 12½ inches; depth, 1⅝ inches.—Bombay, India. (Cat. No. 216055, U.S.N.M.)

7. *Sudra.*—Every Parsee—male or female, priest or layman—must be invested between the ages of seven and fifteen with two articles of dress, called sudra (Avesta, *anabdata*) and the Kusti (Avesta, *aiwyaonghanem*). The former is an undershirt of muslin, linen or gauze and is worn next to the skin; the latter is a girdle made up of seventy-two threads of white wool, representing the seventy-two chapters (*has*) of the Parsee scriptures, in the sacredness of which the neophyte is figuratively bound. The investiture with these two sacred garments, called *Navzot*, which somewhat corresponds to the Christian ceremony of Confirmation, takes place under elaborate solemn ceremonies and is the first important religious ceremony performed over a Parsee child, consists of two parts: the *Nahan* and the *Navzot* proper. The nahan is the religious ablution. The candidate is made to sit on three or more stones either in a temple or on the ground floor of the house and is washed by the priest with consecrated urine of bulls (*nirang*)[12] and holy water, while reciting certain holy texts. When the washing is done, the candidate is dressed in a pair of trousers and cap with a white clean linen sheet wrapped round the upper part of the body. He or she is then conducted into the room where the navzot proper is to be performed. The candidate is made to sit on a flat stool facing the east, the emblem of light. The officiating priests take their place on a rich carpet spread on the floor, while the guests sit around on chairs. A fire is kept burning with sandalwood, frankincense, and other pure fragrant substances. The priests as well as the candidate recite the *Patet*, that is, the confession of sins and repentance. After this the candidate is required to hold the sudra with both hands, and the chief priest, placing his own upon them, causes the candidate to recite the Zoroastrian confession of faith (*Kalma-i-din*): "Most true, full of wisdom and good is the religion which God has sent through Zoroaster to this world. This is the religion of Ahura-Mazda brought to man by Zoroaster." Then with the recitation of certain holy texts the chief priest removes the linen sheet and puts in its place the sudra. The

---

[12] Bull's or cow's urine was thought to possess great purifying and medicinal qualities and an antiseptic for demonic infection. It is called in the Avesta *gaomeza*, Pahlavi and Persian, *gomez*, and when consecrated by special prayers, *nirang*.

chief priest then passes the kusti round the child's waist three times, to remind the wearer of the three cardinal virtues of the Zoroastrian religion, namely, good thoughts, good words, and good deeds, and ties it with four knots, two in front and two behind while chanting a short hymn. At the first knot he says, "There is only one God, and no other is to be compared with him." At the second, "The religion given by Zoroaster is true." At the third, "Zoroaster is the true prophet, who derived his mission from God." And the fourth, "Perform good actions, and abstain from evil ones." After this the candidate is reseated on the stool and the chief priest delivers the *Hosban*, a short sermon in praise of honesty, truth, and purity. This over, he pronounces blessings upon the candidate, throwing over his or her head small pieces of dry fruits, such as cocoanuts, almonds, raisins, rice, etc.

The investiture with the sudra and kusti initiates one into full membership of the Zoroastrian community, entitling to being present in all religious ceremonies and assemblies. And after having undergone the navzot ceremony the Zoroastrian has to put on the sudra and kusti day and night; the performance of any function of life without wearing these two sacred articles of dress is considered a sin, called "Running uncovered with sudra and kusti." The ceremony of untying and retying the kusti (*padyab kusti*), reciting a short prayer during the process, has to be performed several times in the day; for instance, early in the morning on rising from bed, before prayers, before meals, after ablutions, etc.

If a child die before the performance of the ceremony of navzot, he is considered to have gone back to Ahura-Mazda, who gave him, as pure as he entered this world, having not reached the age of accountability.—Bombay, India. (Plate 4, showing the ceremony of investiture with the sudra and kusti, Cat. No. 230800, U.S.N.M.) Gift of Rastamji Edulji Dastoor Peshotan Sanjana, Deputy High Priest of the Parsees, Bombay, India.

8. *Costume of a Parsee.*—It consists of the sudra and kusti (see under the preceding, No. 7), loose cotton trousers, an ample double-breasted coat of cotton, reaching to the ankles, called *jama;* a belt, called *pichori*, made of cotton, about 1 yard wide and several yards in length, which is folded once and passed round the waist as many times as its length will admit; a pair of cotton gloves; a skullcap of cotton; and a turban peculiar to the Parsees. It is made of figured chocolate-colored silk, stiffened, without any rim, and has an angle from the top of the forehead. This costume is only used on formal and solemn occasions.

The dress of the priests is the same only that it is made solely of white cotton cloth, including the turban.—Bombay, India. (Plate 5, Cat. No. 216056, U.S.N.M.)

9. *Suit of a Parsee schoolgirl.*—It consists of the sudra and kusti (for which see under No. 7); trousers of blue silk, richly embroidered; white silk waist, embroidered in various colors; skullcap of cotton;[13] and a flat, rimless hat, adorned all over with silver embroidery.—Bombay, India. (Plate 6, showing a Parsee family, Cat. No. 4009, U.S.N.M.)

10. *Tower of silence* (*Dakhma*).—Model of wood, painted. The rules of clean and unclean and the purifications necessary to repair witting or unwitting infractions of them constitute a large part of practical religion of Zoroastrianism. It is the outcome of the belief that the elements, fire, water, earth, and air are the creations and sublime gifts of Ahura-Mazda, and that on the preservation of their purity depended the weal and welfare of the world. Uncleanliness in the religious sense is considered a demonic contagion, and the sphere in which the presence and agency of demons is most clearly seen is death, and here the greatest precautions must be taken. Inexpiable is the sin that one commits by bringing a corps, a carcass, or any impure object in contact with the elements. If a corpse be found in the water of a well, a pond, or running stream, the water is not fit to drink until the corpse is removed and a great part of the well or stream is drawn off. A field in which a dead body is found lying must remain fallow for a year. The ground in which a body has been buried is unfit for agriculture for fifty years. Even if a man lets fall and remain on earth a bone, a nail, hair, or any like thing he commits a grievous sin. The Parsees, accordingly, neither burn or bury their dead nor consign them to water, but expose them on mountain heights upon the so-called towers of silence (*dakhmas*) to be consumed by vultures.

The *dakhma* is a circular structure of stone, from 60 to 90 feet in diameter and from 20 to 30 feet in height, open at the top and resembling a gasometer. Inside is a circular platform paved with large stone slabs, called *pavis*, upon which the dead bodies are laid. The *pavis* are ranged in three concentric rows, the outer being for men, the middle for women, and the inner for children. The *pavis* are separate from each other by ridges, called *dandas*, which are about an inch in height above the level of the *pavis*, and channels are cut into the *pavis* for the purpose of conveying all the liquid matter flowing from the corpse and rainwater into the pit. The "heaven-sent birds," which are always in the vicinity, swoop down upon the corpse as soon as it is exposed, and it is said that it is quite stripped of flesh in an hour or two. In the center of the platform is a pit (*bhandar*) about 30 feet in diameter, from which four drains lead into four wells sunk in the ground outside of the tower. Into this pit the denuded bones are later deposited where they, under the tropical sun, crumble into dust and are then with all other remaining matter conducted through the drains to the wells. The drains are provided with disinfectants (charcoal and sandstone) to purify the matter before it enters the ground so as to preserve the earth from defilement.

---

[13] The Parsees consider it sinful to leave the head uncovered either by day or night hence neither a man nor a female is ever without some head covering.

When death is near, a priest is called in who recites the confession of sin (*patet*) and sundry passages from the Avesta which afford consolation to the dying person. If he is in possession of his senses he himself joins in these exercises; if not, the words are repeated in his ears. The priest puts into his mouth some drops of the haoma juice (see above under No. 4) as a last sacrament. When life becomes extinct the body is cleaned by first sprinkling a few drops of *nirang* (for which see note to No. 7) and then washing whole with pure water. It is then laid out on the ground on which a clean sheet of cotton has been spread out, and wrapped in clean clothes, which must be old and worn, in order to admit of ready destruction. From that time none is allowed to touch the corpse except the professional carriers of the dead (*nasasalars*). Two priests standing side by side, holding a cord or piece of cloth, called the *paivand*, between their hands, recite the funeral service, called *Gahan-savayashni*, which consists of seven chapters of the first Gatha of Zoroaster (see above, p. 3). A dog—if possible, one with "four eyes," that is, with spots of light color above the eyes, or a white dog with yellow ears—is brought into the chamber in which the body is laid out. This ceremony is called *Sagdid* "glance of the dog," and is repeated several times, for the glance of the dog is a terror to demons. Fire also is brought into the room and is fed with fragrant materials, such as sandalwood, frankincense, etc., the odor of which kills the demons wherever the wind carries it. At the close of the funeral service the corpse bearers having purified themselves, put on white clothes and perform the kusti ceremony (see above under No. 7), place the body upon an iron bier, called *Gehan*, and the funeral procession sets out. This must take place in daytime, for it is essential that the body should be exposed to the sun, and the corpse-devouring birds be present at the tower. The body is covered with a white shroud and secured to the bier with pieces of cloth. Four of the corpse bearers lift the bier on their shoulders and walk toward the tower of silence. They are followed by the funeral procession, headed by priests. All in the procession walk two and two, joined with paivand and reciting prayers. When the procession reaches the tower the bier is put on the ground and the face of the deceased is uncovered. All those who are present take a last look at the deceased, bowing and standing at a distance of three paces. The last sagdid is performed and the bier is carried by two nasasalars into the tower, who, removing the body from it, place it wholly uncovered on one of the pavis. The clothes which were removed from the body are thrown into a deep pit outside the tower, which is purposely made to receive them, and left to decompose by heat, air, and rain. All the participants recite a last prayer, undergo a religious purification, washing their faces, hands, and feet with nirang and water, and perform the kusti ceremony. The nasasalars have to remain in segregation and pass through the *Navshabeh Barashnum* purification which lasts nine days and nine nights.

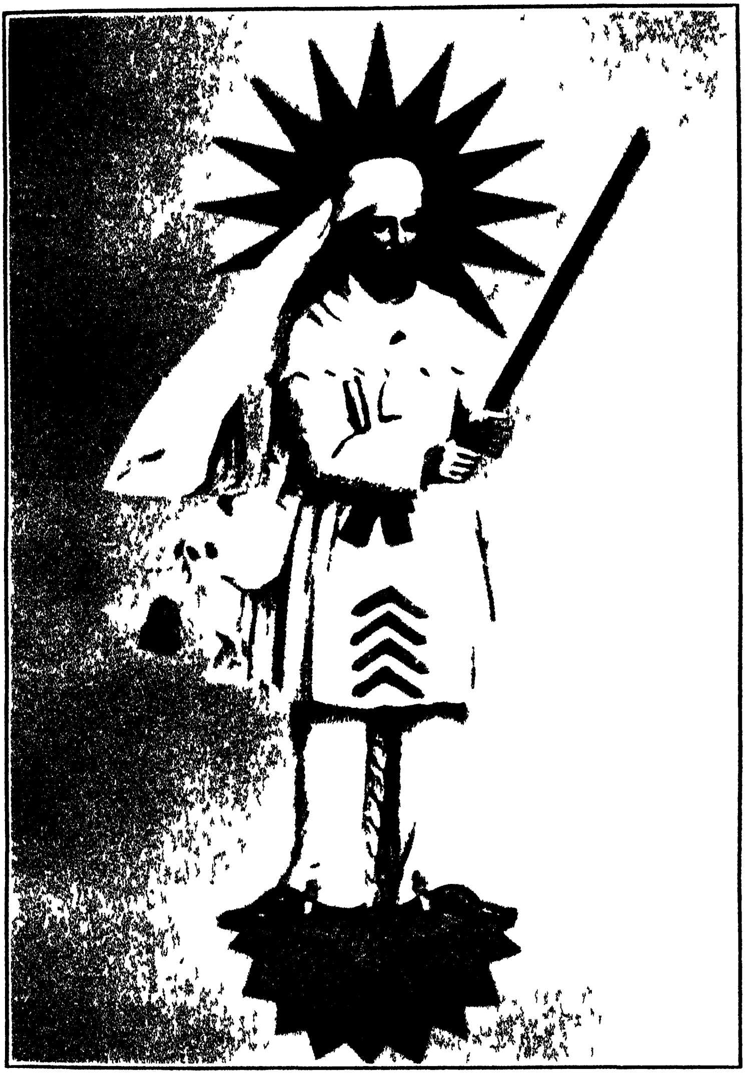
Religious services for the benefit of the deceased are kept up for three days, during which, in the Parsee belief, the soul remains in this world (see above, p. 7). The prayers, recited by a priest before a burning fire fed with fragrant substance, are especially directed to Sraosha, the guide and protector of the souls. On the fourth day, on which the soul confronts the judgment at the chinvat bridge, the *Uthama* ceremony is performed, when after the service the relatives of the deceased, if rich, give sums of money for charitable purposes, feed the poor, and give presents to the priests. During this time the mourners are required to abstain from every kind of flesh. The female relatives sit on a carpet spread on the floor near the spot where the dead body had lain and receive visits from their female friends and connections. No food is prepared in the house before the removal of the corpse, in some families not for the three subsequent days, it being provided for them by relatives and friends.[14]

The principal towers of silence in use at present by the Parsees are on Malabar Hill, at Bombay, India. Height, 17½ inches; diameter, 28 inches; length of the platform, 48 inches; width, 40 inches.—Bombay, India. (Plate 7, Cat. No. 215412, U.S.N.M.)

11. *Tower of silence* (*Dakhma*).—Model of wood, painted. Similar to the preceding, No. 10. Height, 10¾ inches; diameter, 29 inches; length of base, 40 inches; width, 39¼ inches.—Bombay, India. (Cat. No. 301554, U.S.N.M.) Presented to the Library of Congress in Washington, D. C., by Romonjee Dinshaw Petit in March, 1892, and transferred by the Library of Congress to the United States National Museum.

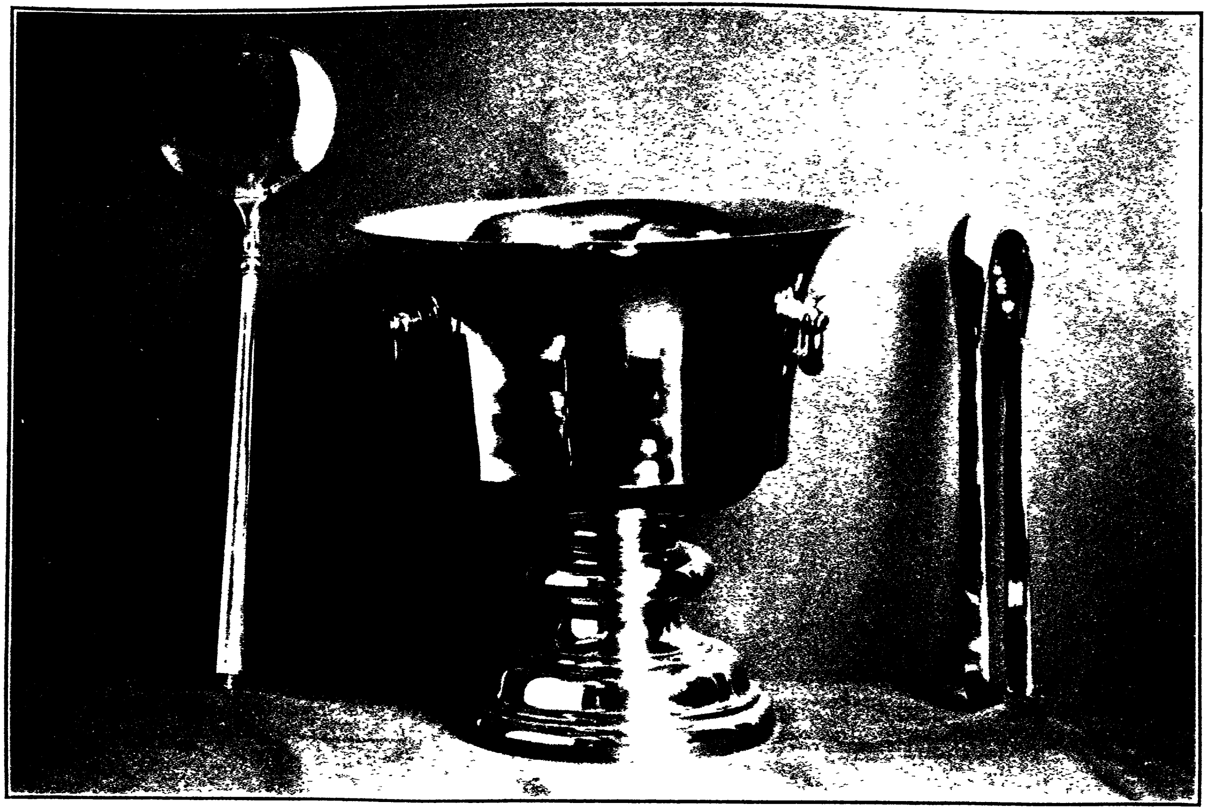
---

[14] Among orthodox Jews a mourner, both male and female, for a near relative—father or mother, son or daughter, brother or sister, wife or husband—is confined to the house for seven days (hence the mourning is called *Shib'ah*, that is, seven), in which he sits on the floor in stocking feet and has to refrain from manual labor or business transactions. The first meal after the funeral is prepared by a neighbor.



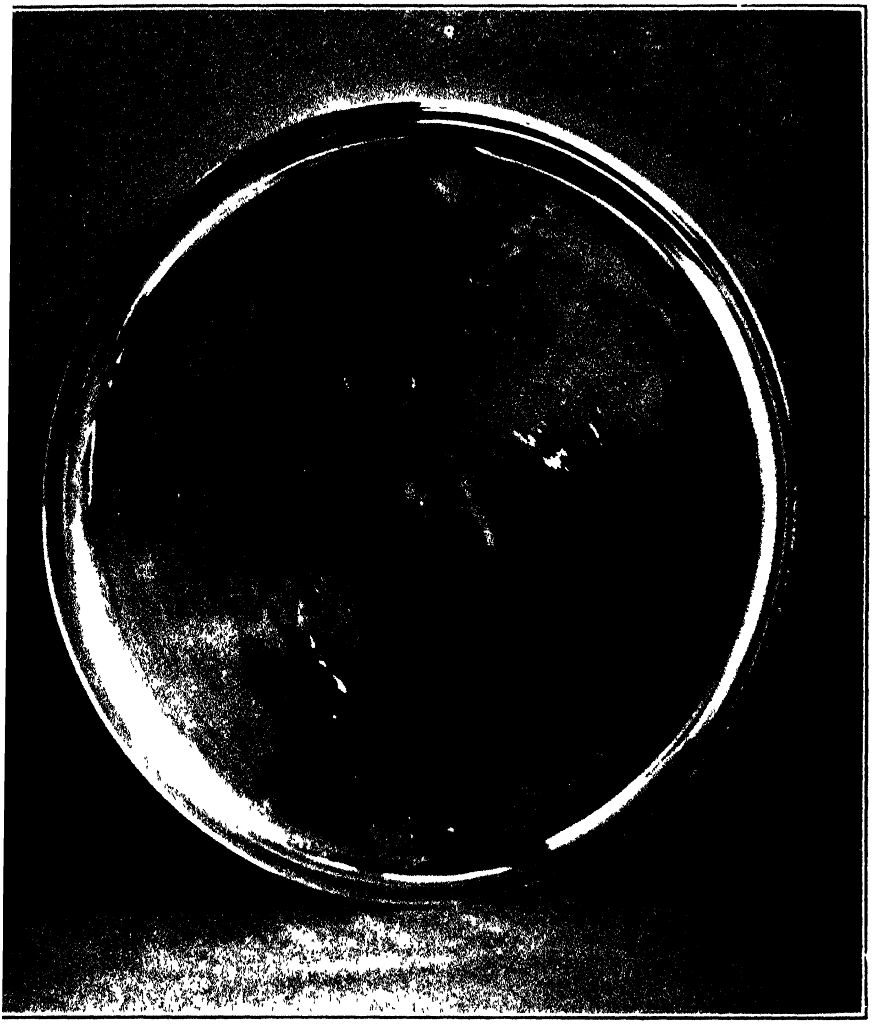
PORTRAIT OF ZOROASTER

FOR DESCRIPTION OF PLATE SEE PAGE 3



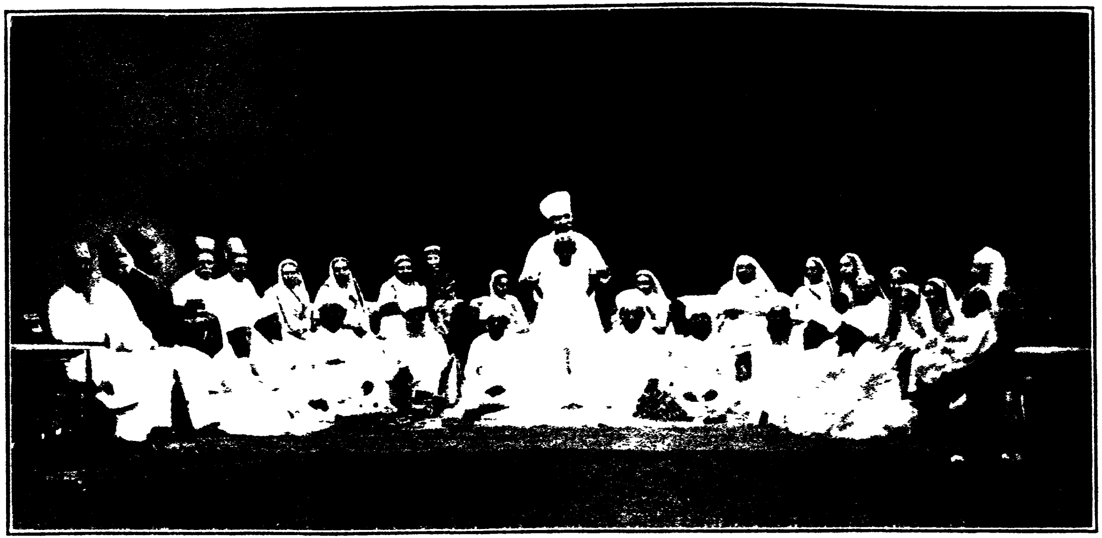
FIRE LADLE (LEFT), FIRE URN (CENTER), FIRE TONGS (RIGHT).

FOR DESCRIPTION OF PLATE SEE PAGE 11



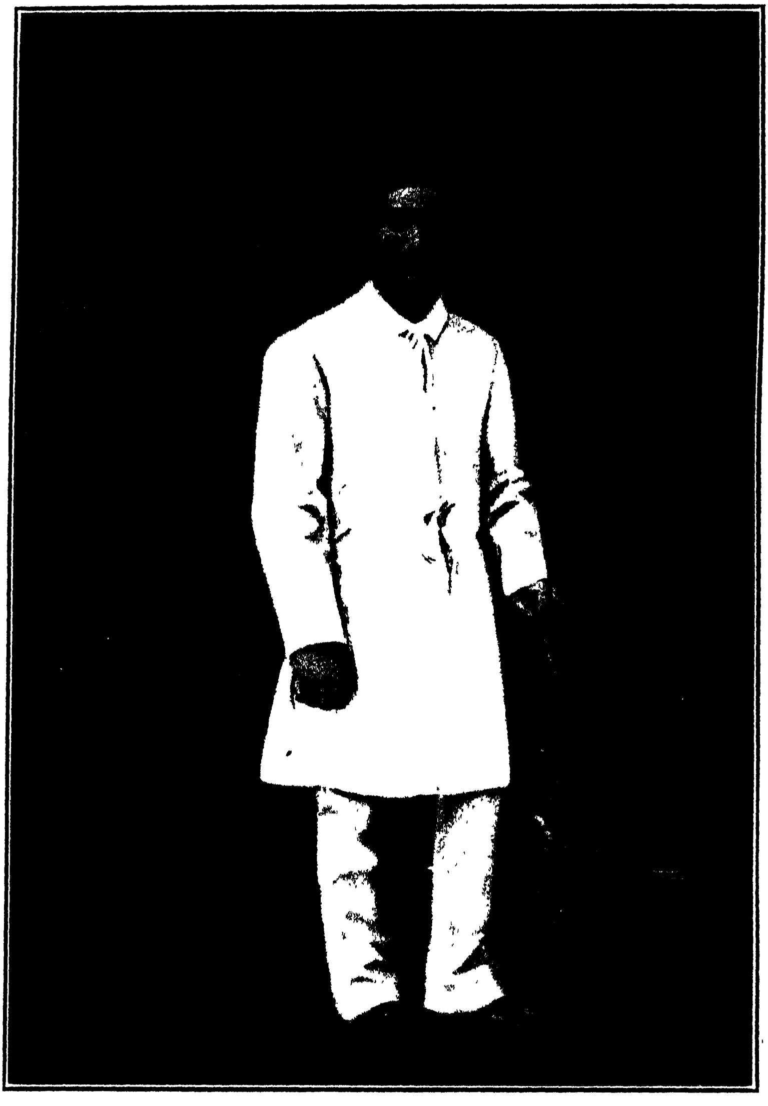
OFFERING TRAY.

FOR DESCRIPTION OF PLATE SEE PAGE 12



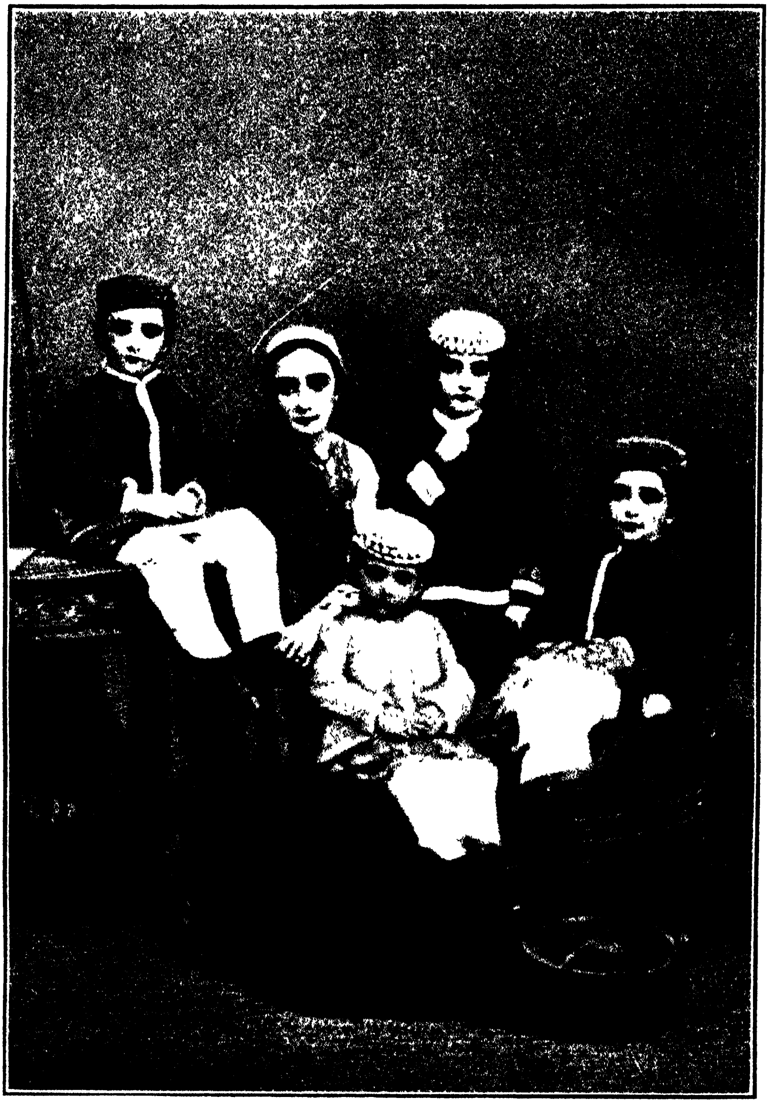
CEREMONY OF INVESTITURE WITH THE SUDRA AND KUSTI.

FOR DESCRIPTION OF PLATE SEE PAGE 13



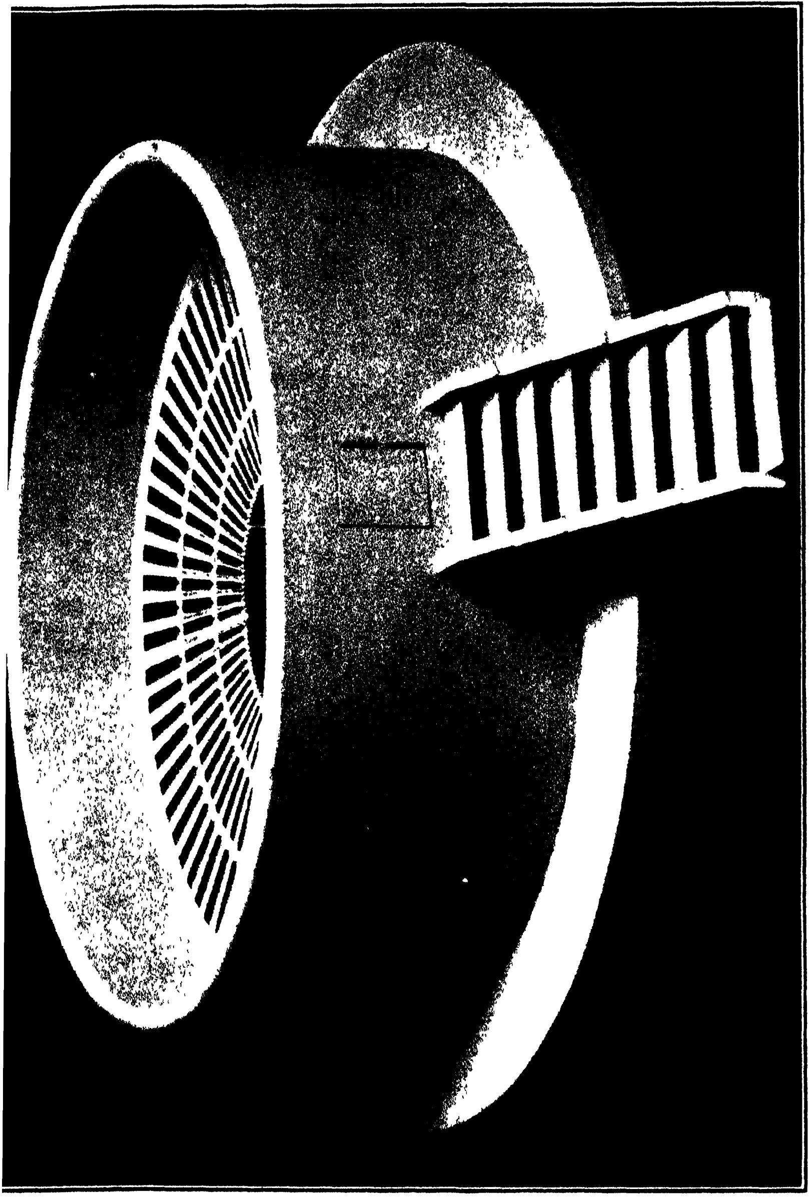
PARSEE GENTLEMAN, SHOWING COSTUME.

FOR DESCRIPTION OF PLATE SEE PAGE 13



PARSEE MOTHER AND CHILDREN, SHOWING COSTUMES.

FOR DESCRIPTION OF PLATE SEE PAGE 14



TOWER OF SILENCE.

FOR DESCRIPTION OF PLATE SEE PAGE 14.

A NEW CESTODE FROM THE MANEATER AND MACKEREL SHARKS.

By Edwin Linton,
Of the University of Missouri, Columbia, Missouri.

The present paper, which is a contribution from the United States Bureau of Fisheries Laboratory at Woods Hole, Massachusetts, and the Zoological Laboratory of the University of Missouri, Columbia, Missouri, deals with a new parasitic Platyhelminth found in the mackerel shark (*Isurus dekayi*) and the maneater (*Carcharodon carcharias*). It also discusses probable larval stages of the same.

1. DESCRIPTION OF SPECIES.

PHYLLOBOTHRIUM TUMIDUM, new species.

Type.—Cat. No. 7631, U.S.N.M.

Scolex.—Bothria in pairs corresponding with the flat surfaces of the strobile, apparently sessile in preserved specimens, but really attached by very short pedicels, thin and leaf-like when extended, with frilled or crumpled (lacinio-crispate) margins; each provided with a conspicuous auxiliary sucker. Anterior end of scolex prolonged beyond the bothria forming an eminence which is dome-shaped in outline in dorso-ventral, and conical, in marginal view.

The bothria, as usually seen in preserved specimens, are contracted into frilled and puckered folds to such a degree that their real nature is difficult to interpret. A few were killed while still attached to the mucous membrane of their host, and in them the real character of the bothria is fairly well shown. Figures 2 and 3 are sketches of bothria thus prepared. They are seen to be very thin and leaf-like structures. That the bothria are not sessile, although appearing to be so, may be demonstrated in scoleces which have been fixed under pressure. Also, although the bothria are seated dorsoventrally in pairs, they may appear, in front view, under pressure, to be cruciform. In sections the outer portion of the wall is seen to be a dense layer of short muscle fibers lying at right angles to the surface. This layer is of the same essential structure as that of the auxiliary suckers. The central portion of the bothria is continuous with the parenchymatous tissue of the strobile. The longitudinal muscle fibers of the strobile continue into the bothria, where they radiate to the external dense layer to which they are attached. It is the unequal contraction of these muscle fibers which causes the crumpling and folding of the bothria. A loop of the water-vascular system enters each bothrium where it follows a course in the main parallel with the margin, and distant from the margin about one-fourth the diameter of the bothrium.

Ganglion cells were noted in sections of the scolex in the following situations: In the axial parenchyma and myzorhynchus where they were relatively few and small (fig. 11). Larger cells were noted in the bundles of muscle fibers, in the pedicels, and central portions of the bothria. Others were noted in the dense superficial layer, appearing to be relatively more numerous in the central portions of the bothria; others in the compact tissue of the auxiliary suckers, and in the superficial layer of the back of the bothria. The ganglion cells of the dense tissue, and many of those which are associated with muscle fibers in the parenchyma, are characterized by having large nuclei with conspicuous nucleoli, the cytoplasm much branching and with rather indefinite limits (fig. 12). The cells belonging strictly to the parenchyma, and some of those which are associated with long muscle fibers have definite outlines, which are more or less oval. One of these small oval-elliptical cells measured 0.012 mm. in the longer diameter; near by was another 0.03 mm. in diameter, with a nucleus measuring 0.012 and 0.009 mm. in the two principal diameters. Figures 12, *a* to *f*, are camera lucida stretches of ganglion cells as they appeared in a series of sections of a scolex.

Strobile.—Rather slender, linear and flattened throughout. Segments begin a short distance back of the scolex as crowded transverse lines. The proglottides are at first very much broader than long, ultimately becoming squarish, then longer than broad. Maturing and adult proglottides longer than broad, with bluntly rounded angles. Free proglottides much longer than broad, the anterior end usually more or less rounded or knob-like.

In a specimen mounted in balsam, at a point 3 mm. back of the scolex, where the strobile was 0.6 mm. in breadth, the proglottides were 0.04 mm. in length. This specimen was 12 mm. in length. The last four proglottides averaged 0.42 mm. in length; the breadth was 0.28 mm. The last segment was more slender and longer than the preceding three, which did not differ much in length and breadth. The length of the posterior segment was 0.7 mm.; its breadth was 0.21 mm. at the anterior end, tapering to 0.12 mm. near the posterior end. The last 10 segments of a larger strobile averaged 0.9

mm. in length; the length of the first of the series was 0.77 mm., its breadth 1.19 mm.; length of penultimate segment 1.05 mm., breadth 1.05 mm. Length of last segment 1.82 mm., breadth 0.98 mm. near anterior end, tapering to 0.5 mm., near posterior end. A free, ripe segment, mounted in balsam, has the following dimensions: Length 7 mm.; breadth at anterior end 0.42 mm., at level of genital pore (maximum) 2.10 mm., near posterior end 0.42 mm. Dimensions of a free segment in which ova had not begun to develop: Length 4.5 mm.; breadth near anterior end 0.50 mm., at level of genital pore (maximum) 2.27 mm., near posterior end 0.77 mm.

The musculature of the strobile is weak. Beneath the cuticular layer there is a layer of longitudinal muscles, the fascicles of which are flat and ribbon-like, with the long axis of their section at right angles to the surface. The fibers are very fine. In a transverse section near the scolex the thickness of the muscular layer was about one-ninth the shorter diameter of the section. A diagram of the muscle layer is shown in figure 10. No circular muscles were noted in any of the sections.

The cuticle in sections near the scolex is smooth, but farther back becomes transeversely rugose. This condition is best seen in sagittal sections (fig. 13).

Reproductive organs.—The genital pores are on the lateral margins. irregularly alternate, and, in adult segments, situated at about the anterior third.

Male.—The cirrus is long, tapering, and spinose. The cirrus pouch has rather weak walls, and lies on the posterior side of the horizontal portion of the vagina. In adult, but unripe, joints the retracted cirrus lies in several folds in the pouch. Beginning at the genital pore it passes postero-mediad at an angle of about 45 degrees with the lateral margin, then becomes slightly tortuous, and continues antero-mediad as the vas deferens, which forms voluminous folds about the anterior curved portion of the vagina.

The testes are distributed along the mid region of the proglottis, from a point approximately midway between the anterior end and the curve of the vagina, to the anterior border of the ovary, and occupy about one-half the width of the proglottis.

Female.—The vagina opens at the genital pore in front of the cirrus. Its course is at first antero-mediad to near the median line, where it turns abruptly posteriad to follow the median line until near the posterior end of the proglottis, where it joins the germ duct. Near the exterior it is slightly constricted; beyond the constriction it enlarges rather abruptly, then tapers more slowly to the curve, so that the portion which is directed antero-mediad is fusiform. At the curve and along the median line the diameter is reduced and remains nearly uniform. The course along the median line is nearly straight, or, in some cases, slightly sinuous, until a short distance in front of the ovary, where it forms a close spiral and functions as a seminal receptacle.

The ovary lies near the posterior end of the proglottis, and consists of two fan-shaped divisions, symmetrically placed with reference to the median line. Each half is made up of numerous tubular or long-pyriform lobules. The two divisions are connected by a common transverse portion at the mid line. The shell gland lies on the mid line behind the transverse connecting portion of the ovary and between the two divisions, and is thus practically surrounded by the ovary. The short germ duct begins with a muscular, funnel-like enlargement (ootype), is soon joined by the sperm duct, and a little later by the single yolk duct. The common duct now enters the shell gland, from which it emerges as the oviduct which passes ventrad and shortly expands into the uterus. The main yolk duct is short and is formed by the meeting of two ducts, one from either side of the proglottis (fig. 7). The vitellaria are distributed mainly along the lateral regions of the proglottis, but also extend more or less mediad so as to overlap the testes. They begin near the anterior end of the proglottis, anterior to the testes, and continue to the posterior end. In mature proglottides, in which eggs have not appeared, the vitellaria are quite dense, glandular organs. In joints in which there are considerable numbers of eggs in the uterus, the vitellaria appear as slender, short, string-like masses of yolk cells. This condition begins at the anterior end of the proglottis and progresses toward the posterior end (fig. 8).

The uterus lies along the median line on the ventral side. Figure 6 shows it in section in a mature proglottis which had not yet begun to form eggs. As the segment ripens the uterus becomes greatly enlarged, somewhat sacculate, and ultimately comes to occupy practically all of the interior of the proglottis. The ova are small, and have thin shells. In all of my mounted material the shells have collapsed, so that the ova have very irregular, and more or less angular, outlines. The diameter is about 0.02 mm.

Eggs are discharged by way of a relatively large, longitudinal opening, which appears by dehiscence, on the ventral side of ripe proglottides.

2. NOTES ON HABITAT, DISTRIBUTION, ETC.

A. ADULT STAGE.

1. CARCHARODON CARCHARIAS.

The type (Cat. No. 7631, U.S.N.M.) was collected on June 20, 1903, by Vinal N. Edwards at Woods Hole, Massachusetts, from the stomach of a maneater shark. No food notes accompanied the specimen, but crystalline lenses and teeth of fish were found in one of the bottles containing material from this host, examples of which had been examined by Mr. Edwards on different dates, all in the same month.

The specimen was much contracted, being coiled in a close spiral at the anterior end. The scolex and neck were of a lighter color than the body, which was yellowish white. The breadth of the scolex was 2.5 mm., of the neck 2 mm.; posterior segments long and narrow with a dark line along the median axis. Length of strobile, estimated, 90 mm.

September 1, 1903. A small maneater shark, 4 feet in length, was examined by me at Woods Hole on this date. The stomach contained fish and squid. About 50 of these cestodes were found, most of them in the spiral valve, but a few, 2 or 3, in the stomach. As most of these strobiles appeared to be immature, and, moreover, were associated with jaws and pens of squid, they were interpreted as having been introduced with squid. Two of the strobiles were longer and stouter than the others, which measured about 30 mm. in length. They all contracted strongly when placed in killing fluid.

June 11, 1906. Five specimens were collected by Mr. Edwards from a maneater shark taken off Nantucket on this date. The stomach was empty. These worms, as preserved specimens, were much contracted, and more or less coiled. One, straighted in glycerin, measured 30 mm.

July 1, 1906. A 6-foot maneater shark, taken in Buzzards Bay near Woods Hole, was examined by me on this date. Lenses of fish were found in the stomach. In the spiral valve were found 20 cestodes of this species, with numerous free proglottides containing eggs. The eggs were small, spherical, with rather weak shells, and were dark colored. Length of strobile about 70 mm. They were rather active and had a tendency to crumple and tie themselves in knots. Ripe proglottides flattened under cover-glass measured 9 mm. in length and 3.5 mm. in breadth. Bothria, more or less expanded, were obtained by dropping formaldehyde on scoleces while they were still attached to the mucous membrane of the intestine.

August 17, 1916. A maneater shark measuring 12 feet 7 inches, taken at Menemsha Bight, was examined on this date. The shark had been dead for at least one day, but the scoleces, three with strobiles and one without, were still quite active. The stomach of the shark was empty, but the contents of the spiral valve were dark colored, suggesting that squid had been recent food. It was noted that the behavior of the bothria was like that of the larval forms often found in squid. The auxiliary suckers were alternately extended and retracted on stalk-like projections of the bothria. Also the front end of the scolex between the bothria was actively extended into a sharp-pointed cone which retracted to a rounded eminence when at rest. The strobiles measured about 30 mm. in length. Proglottides began about 8 mm. back of the scolex. The maximum diameter of the scolex was about 2 mm. and the length about the same. There were no mature segments.

2. ISURUS DEKAYI.

August 9, 1905. A mackerel shark, examined on this date at Woods Hole, contained lenses of fish in the stomach and a broken spine of *Squalus acanthias* embedded in the stomach wall. Nineteen cestodes, similar to those found in the maneater shark, were found in the spiral valve. These were from 10 to 160 mm. in length, living, although the longest alcoholic specimen is only 65 mm. in length. The first distinct segments were about 20 mm. back of the scolex. The first segments very indistinct, succeeding ones very short, ultimately becoming squarish, then longer than broad. There were no ripe segments. The bothria were leaf-like, very mobile and assuming a great variety of shapes, but contracting into a cauliflower-like structure when placed in alcohol.

August 21, 1905. The spiral valve of a mackerel shark taken at Menemsha Bight, which had been in formaldehyde for a few days, was examined on this date. No note had been made of the stomach contents, but the beak of a squid was found in the spiral valve, along with 21 scoleces, and many fragments of strobiles similar to those collected on the 9th, but with rather larger scoleces.

B. LARVAL STAGE.

Larval cestodes belonging to the genus Phyllobothrium are common in the squid of the New England coast, both the northern species, *Ommastrephes illecebrosa*, and the southern species, *Loligo pealii*. There are good reasons for thinking that these represent an immature stage of the species described in this paper.

In 1887 Leidy[1] described larval cestodes from the squid *O. illecebrosa*, under the name *Taenia loliginis*, and again,[2] under the name *Tetrabothrium loliginis*. In the latter account he designates the cestode as the scolex of *Tetrabothrium* Rudolphi, or *Phyllobothrium* Van Beneden.

P. J. van Beneden, in 1870,[3] published a description of a cestode, under the name *Phyllobothrium delphini* Ed. van Beneden, of which his son had collected the material in 1868. The worms were found in the subcutaneous fat of a porpoise, where they occurred in large numbers in the form of cysts, yellow in color, and one centimeter in diameter, and which were recognized by the son as representing the larval stage of a Phyllobothrium. Van Beneden's figure of the scolex of *P. delphini* bears a very close resemblance to the larval Phyllobothria from the squid of the New England coast.

---

[1] Proc. Acad. Nat. Sci., Phila., 1887, p. 24.

[2] Idem, 1890, p. 418.

[3] Bull. Acad. Belg., vol. 29, pp. 115–117.

Following is a list, with brief notes, of hosts in which I have found larval Phyllobothria, which have usually been recorded in my notes as *Phyllobothrium loliginis.*

1. *Ommastrephes illecebrosus.*[4]
2. *Loligo pealii.*

July 28, 1904; food, small menhaden; 1, and 2 fragments.

July 29, 1904; 2, and 2 fragments.

August 8, 1904; 1; length 20 mm. in sea water, 40 mm. after lying for a short time in fresh water.

August 8, 1906; food, fragments of fish; 1, from stomach; length 20 mm., shrunk to about half this length when placed in alcohol.

July 6, 1912; a few found in stomach, 20 mm., more or less, in length; a smaller larval cestode, *Scolex polymorphus*, also noted.

July 8, 1913; 8, in stomach.

3. *Mustelus canis.*

June 6, 1904; 5 dog-fish examined by Vinal N. Edwards; food, squid, lobster, and sand crabs; 3 larval cestodes found.

July 9, 1904; 1 cestode from stomach; active, varying from 15 to 25 mm. in length; neck pink or flesh color, body ivory white, bothria crumpled on edges, lateral vessels sinuous and plainly showing in the neck; agrees exactly with published descriptions of *Phyllobothrium loliginis.* This specimen was given me by Dr. W. C. Curtis, who reported that he had been finding squid in the stomachs of dog-fish which he had been opening, but had not made any note of the stomach contents of the host from which he had collected this worm.

July 25, 1904; 3 dog-fish examined, 1 larval cestode found.

July 30, 1904; 2 dog-fish examined; food, menhaden; 3 larval cestodes, longest 34 mm.

May 16, 1905; 1 examined; stomach contained squid; 1 larval cestode found.

May 23, 1905; 10 examined; stomachs contained squid, alewife, and crabs; 1 larval cestode found in one of the dog-fish, and 4 in another.

May 31, 1912; 4 examined; 6 larval cestodes found.

The examinations reported under the three dates in May were made by Mr. Vinal N. Edwards. Dog-fish examined by Mr. Edwards on one date in July, four in August, and one in September contained no larval cestodes.

---

[4] See Proc. U. S. Nat. Mus., vol. 19, p. 792, pl. 52, figs. 1–9.

Summary.—*Phyllobothrium loliginis* found in *Mustelus canis* on three dates in May, 14 fish examined, 10 larval cestodes found; on one date in June, 5 fish examined, 3 larval cestodes found; on three dates in July, 7 fish examined, 5 larval cestodes found.

Examinations of *M. canis*, no examples of *P. loliginis* found: On two dates in May, 14 fish examined; five dates in June, 28 fish examined; four dates in July, 6 fish examined; nine dates in August, 1 fish examined; three dates in September, 5 fish examined; two dates in October, 3 fish examined.

Squid were recorded in the food on two dates in May, four in June, and one in October, not including dates on which *P. loliginis* was found.

4. *Squalus acanthias.*

The following collections from the spiny dog-fish, with the exception of those made on July 20, were made by Vinal N. Edwards.

May 10, 1904; 20; stomachs filled with squid, alewife, and crabs; larval cestodes in one, 6 scoleces, longest 24 mm., in formaldehyde.

May 19, 1904; 8; stomachs with squid and herring; 6 larval cestodes from stomach of one.

May 20, 1904; 15; stomachs with squid and herring; 10 larval cestodes, from 7 to 20 mm. in length.

June 6, 1904; 100; stomachs with razor clams, squid and eelgrass; larval cestodes found in 18; 84 scoleces, also a number of fragments without scoleces.

May 29, 1905; 12; stomachs filled with young herring; 1 larval cestode found, length 7 mm.

May 14, 1906; 7; stomachs filled with squid; 5 larval cestodes found, 1 quite immature, with scolex inverted.

September 2, 1907; 26, from Provincetown, Massachusetts; squid in stomachs of most of them, fish in a few; 2 larval cestodes in stomach.

May 11, 1908; 32 larval cestodes in bottle, length 20 mm., more or less.

May 20, 1911; no food notes. One of the bottles contained squid eggs; 7 larval cestodes.

May 22, 1912; 40; stomachs full of squid and "jellyfish" (*Pleurobrachia*); 1 larval cestode.

July 20, 1915; 16; spiral valves only brought to the laboratory. All but three of these were examined by Dr. G. A. MacCallum; crystalline lenses of fish noted; 4 small larval cestodes found in one, maximum length, in alcohol, 4 mm. This material came from Sandwich, Massachusetts.

June 2, 1916; 2 larval cestodes, much contracted; no food notes.

Since these specimens of *Phyllobothrium loliginis* from the spiny dog-fish were all immature, and were, with very few exceptions, in the stomach, where they had evidently been recently introduced with the food, *Squalus acanthias* can not be regarded as a final host of this species.

Summary.—Spiny dog-fish were examined on many occasions when no specimens of *Phyllobothrium loliginis* were found. Thus, summarizing by months, the following examinations of spiny dog-fish were made in which this larval cestode was not found: One date in April, 2 fish examined; seventeen dates in May, 112 fish examined; four dates in June, 6 fish examined; two dates in July, 9 fish examined; 7 dates in August, 1 fish examined; four dates in September, 56 fish examined; seven dates in October, 267 fish examined; eight dates in November, 121 fish examined.

To this may be added à summary by months of examinations of spiny dog-fish when examples of *P. loliginis* were found: Eight dates in May, 114 fish examined, 68 larval cestodes recorded; two dates in June, 101 fish examined, 86 larval cestodes recorded; one date in July, 16 fish examined, 2 cestodes recorded; one date in September, 26 fish examined, 2 larval cestodes recorded.

Squid were recorded in the food on one date in April, six in May, two in July, three in August, two in September, two in October, and one in November, not including dates on which *P. loliginis* was found.

5. *Raja ocellata.*

Practically all of the collections from the winter skate here recorded were made by Vinal N. Edwards.

May 12, 1904; 15; stomachs contained razor clams and crabs; 16 larval cestodes from 2 fish.

May 17, 1904; 1; 6 larval cestodes.

May 17, 1905; 7; stomachs filled with "mollusk and squid"; 4 larval cestodes, length of largest 6.5 mm., breadth 2 mm.

May 10, 1906; 10; stomachs filled with crabs; 2 larval cestodes.

May 14, 1906; 7; stomachs contained squid; 1 larval cestode.

May 11, 1908; 6; 27 larval cestodes, length 16 mm., more or less.

June 3, 1909; 1; 11 larval cestodes.

May 13, 1911; 6; stomachs full of squid; 18 larval cestodes from 2 fish.

May 15, 1914; 35; squid in stomachs; 13 larval cestodes from 9 fish.

May 18, 1914; 10; squid in stomach; 5 larval cestodes, 2 with scoleces invaginated.

June 6, 1914; 2; squid in stomachs; 1 larval cestode.

Summary.—*Phyllobothrium loliginis* was found in *Raja ocellata* on nine dates in May, 97 fish examined, 92 larval cestodes; on two dates in June, 3 fish examined, 12 larval cestodes.

Examinations of *R. ocellata* in which no examples of *P. loliginis* were found: On eleven dates in April, 61 fish examined; thirty dates in May, 203 fish examined; four dates in June, 6 fish examined; two dates in July, 9 fish examined; eight dates in August, 16 fish examined; six dates in September, 138 fish examined; sixteen dates in November, 75 fish examined.

Squid were recorded in the food on one date in April, five in May, two in June, one in August, two in September, seven in October, and one in November, not including dates on which *P. loliginis* was found.

6. *Raja laevis.*

The great majority of the examinations here recorded were made by Vinal N. Edwards.

May 10, 1904; 5; stomachs filled with crabs and razor clams; 25 larval cestodes, longest 20 mm.

May 12, 1904; 1; stomach filled with alewife, crabs and razor clams; 6 larval cestodes.

May 13, 1904; 1; 2 larval cestodes.

May 9, 1914; 2; crabs in stomach; 1 larval cestode, length 20 mm.

Summary.—Phyllobothrium loliginis was found in *Raja laevis* on four dates in May, 9 fish examined, 34 cestodes found.

Examinations of *R. laevis* in which no examples of *P. loliginis* were found: April, seven dates, 14 fish examined; May, twenty-three dates, 36 fish examined; June, three dates, 3 fish examined; July, one date, 3 fish examined; August, three dates, 11 fish examined; September, two dates, 3 fish examined; October, twenty dates, 53 fish examined; November, five dates, 9 fish examined.

Squid were recorded in the food on nine dates in May, two in June, one in July, one in September, four in October, and one in November.

7. *Thunnus thynnis.*

June 29, 1915; 1; stomach contained 26 squid (*Loligo pealii*), number estimated from "pens" which ranged in length from 110 to 245 mm., also the vertebrae and ribs of a small fish. Ten specimens of *P. loliginis* found, 9 in the stomach and 1 in the intestine. Some of these allowed to lie in sea water were still active on July 1, and some movement in the scolex and neck was discernable on July 3.

Examinations of *Thunnus thynnis* in which no examples of *P. lologinis* were found: On two dates in June, 2 fish examined; two dates in July, 2 fish examined; two dates in August, 2 fish examined; one date in September, 2 fish examined.

Food recorded: Squid, butterfish, herring, and mackerel; algae and eelgrass reported by Vinal N. Edwards from two small horse mackerel examined in September. Squid recorded on one date in July.

8. *Xyphias gladius.*

July 15, 1904; 4; fish taken on the 14th. Food: Fish and squid. One specimen of *P. loliginis* was found which was somewhat contracted, but measured 10 mm. in length and 3 mm. in breadth, when compressed under the cover-glass. Besides this there were rather numerous very small cestode larvae (*Scolex polymorphus*), from 0.1 to 0.75 mm. in length. There appeared to be the beginning of auxiliary suckers on the bothria of these larvae. Associated with these larvae were others, considerably larger, some of them with necks differentiated from the body, with sinuous lateral vessels, distinct auxiliary suckers. The smaller examples had two red pigment blotches in the neck, length 3 mm.

July 20, 1904; 3; fish, hake and menhaden, in stomach of one fish.

Several examples of *P. loliginis* found; other larval cestodes, smaller, and, if not associated with this species, and allied to it by intermediate forms, would be called *Scolex polymorphus.*

July 28, 1904; 1; fish in stomach. *P. loliginis;* 9, grading into forms ordinarily recorded as *Scolex polymorphus.*

July 7, 1913. Dr. G. A. MacCallum showed me a larval cestode from a swordfish which he was examining on this date. The length of the specimen was 10 mm. The general appearance of the worm, which was still active, was like that of *Phyllobothrium loliginis.* The bothria, however, had rather thicker borders, and the auxiliary suckers were relatively larger and deeper than usual.

Sketches of two of these larval cestodes from the swordfish are shown in figures 14 and 15.

Besides the above, I have records of the examination of swordfish, in which no larval cestodes were found in the stomach or intestine, as follows: On five dates in July, 8 fish examined; food, fish in 6, fish and squid in 2.

9. *Spheroides maculatus.*

Collections made by Vinal N. Edwards.

June 4, 1904; 20; "stomachs contained shell-fish"; 2 larval cestodes found in one fish.

June 6, 1914; 10; squid in stomachs; 5 larval cestodes from 4 fish; length of longest worm 30 mm.

I have records of examinations of puffers in which no examples of *P. loliginis* were found as follows: On six dates in May, 81 fish examined; fourteen dates in June, 123 fish examined; ten dates in July, 23 fish examined; seven dates in August, 112 fish examined; six dates in September, 8 fish examined. All the collections made in May and June and a part of those made in the other months were made by Vinal N. Edwards.

Squid were recorded in the food on three dates in June.

10. *Hemitripterus americanus.*

May 31, 1907; 1; 8 larval cestodes.

May 26, 1917; 1; squid in stomach; 3 larval cestodes, 7 to 32 mm. in length.

Sea-ravens, in which no examples of *P. loliginis* were found, were examined as follows: On three dates in January, 9 fish examined; one date in February, 5 fish examined; three dates in April. 5 fish examined; six dates in May, 6 fish examined; four dates in June, 4 fish examined; one date in July, 1 fish examined; five dates in October, 7 fish examined: five dates in November, 10 fish examined; three dates in December, 7 fish examined.

Practically all of the examinations of this host were made by Vinal N. Edwards.

Squid recorded in the food on two dates in May.

11. *Lopholatilus chamaeleonticeps.*

July 29, 1899; 2 larval cestodes, from intestine.[5]

12. *Merluccius bilinearis.*

July 11, 1900; 3 larval cestodes.[6]

July 2, 1910; 12; squid in stomachs; 1 larval cestode. This specimen was very active. When first seen the scolex and a part of the neck were invaginated; later they were everted. It was still active after it had been lying in sea water for three hours. The neck was a translucent light brown, or tan color, the scolex and body white. The bothria attached themselves to other parasites in the dish and to the bottom of the dish. The neck was very contractile, changing quickly from a thin, linear shape to a thick, crumpled mass. The body, also, was very active, much of the time being elongate, tapering and whip-like.

Whiting were examined, in most cases by Vinal N. Edwards, without finding *P. loliginis*, as follows: On seven dates in May, 34 fish; two dates in June, 3 fish; three dates in July, 16 fish; eight dates in August, 52 fish; two dates in September, 2 fish; nineteen dates in October, 132 fish; thirty-eight dates in November, 331 fish.

Squid were recorded in the food on three dates in May, one in June, one in July, three in August, five in October, and three in November.

13. *Pollachias virens.*

July 1, 1912; 18; food, squid; a few larval cestodes, evidently introduced with the food.

June 9, 1913; 6; stomachs full of squid; 9 larval cestodes.

Other examinations of pollock, for the most part made by Vinal N. Edwards, in which *P. loliginis* was not found: On one date in March, 4 fish; eleven dates in April, 29 fish; twelve dates in May, 44 fish; eight dates in June, 63 fish; two dates in July, 2 fish; four dates in August, 13 fish; seven dates in September, 7 fish; twenty-eight dates in October, 54 fish; eight dates in November, 21 fish; one date in December, 1 fish.

---

[5] Bull. U. S. Fish Comm. for 1899, p. 471, pl. 20, figs. 233–234.

[6] Idem, p. 474, pl. 20, figs. 231–232.

Squid were recorded in the food on one date in May, four in June, one in October.

14. *Phycis tenuis.*

June 7, 1907; 2; squid in stomachs; 85 larval cestodes, in stomach, evidently introduced with squid.

June 5, 1914; 1; squid in stomach; 4 larval cestodes in stomach.

June 15, 1916; 2; squid in stomach; 4 larval cestodes, in stomach.

Following is a summary of examinations of this host, all of which, with the exception of those in the month of August, were made by Vinal N. Edwards. *P. loliginis* was not found on any of these dates, although squid is recorded in the food of practically all of those examined in May and June and on one date in October and one in November.

Summary.—On eight dates in May, 10 fish examined; one date in June, 1 fish examined; four dates in August, 12 fish examined; one date in September, 1 fish examined; sixteen dates in October, 44 fish examined; eighteen dates in November, 88 fish examined; three dates in December, 5 fish examined.

15. *Phycis chuss.*

May 17, 1904; 6; stomachs filled with squid; 1 larval cestode. length 10 mm.

May 14, 1905; 5; stomachs filled with squid; 1 larval cestode.

June 13, 1907; number of fish examined not stated; stomachs filled with herring; 62 larval cestodes.

May 2, 1913; 2; stomachs filled with sand-eels and crabs; 8 larval cestodes.

May 23, 1914; 20; squid in stomach; 9 larval cestodes.

May 25, 1914; 15; squid in stomach; 5 larval cestodes.

May 15, 1914; 30; squid and *Nereis* in stomachs; 9 larval cestodes.

June 5, 1914; 10; squid in stomachs; 60 larval cestodes.

May 15, 1915; 8; herring in stomachs; 5 larval cestodes.

June 5, 1914; 10; squid in stomachs; 60 larval cestodes.

The examinations of this host were nearly all made by Vinal N. Edwards.

Summary.—Following is a summary of examinations when no examples of *P. loliginis* were found: On eleven dates in May, 77 fish examined; four dates in August, 16 fish examined; seven dates in September, 33 fish examined; forty-seven dates in October, 335 fish examined; forty dates in November, 478 fish examined.

Squid were recorded in the food on five dates in May, two in August, two in September, ten in October, and three in November, not including dates on which *P. loliginis* was found.

16. *Paralichthys dentatus.*

May 26, 1904; 1; menhaden and razor clams in stomach; 13 larval cestodes in stomach, from 5 to 16.5 mm. in length, breadth of scolex 1.5 to 2 mm.

May 27, 1904; 1; stomach filled with menhaden; 21 larval cestodes, from 5 to 16 mm. in length.

May 24, 1910; stomach filled with alewife; 8 larval cestodes.

Examinations of this host, except on dates in July and August, were made by Vinal N. Edwards.

Summary.—Following is a summary of examinations when *P. loliginis* was not found: On two dates in June, 2 fish examined; seven dates in July, 10 fish examined; twenty dates in August, 57 fish examined; nine dates in September, 10 fish examined; fifteen dates in October, 20 fish examined; three dates in November, 3 fish examined.

Squid were recorded in the food on one date in July, five in August, two in September, and two in October.

17. *Paralichthys oblongus.*

May 31, 1907; 8; young herring in stomachs; 1 larval cestode.

Summary.—The other examinations, most of them by Vinal N. Edwards, of *P. oblongus*, in which no examples of *P. loliginis* were found, were as follows: On seven dates in May, 12 fish examined; ten dates in June, 36 fish examined; three dates in August, 6 fish examined; one date in September, 1 fish examined.

Squid were recorded in the food on one date in May, two in June, and one in August.

18. *Lophius piscatorius.*

May 31, 1913; 1; tautog and squid in stomach; 2 larval cestodes.

Summary.—Examinations of goose fish in which *P. loliginis* was not found were as follows: On one date in January, 1 fish; one date in April, 1 fish; eight dates in May, 34 fish; six dates in June, 8 fish; nine dates in July, 17 fish; six dates in August, 7 fish; five dates in September, 5 fish; nine dates in October, 13 fish; thirteen dates in November, 15 fish; four dates in December, 6 fish.

Squid were recorded in the food on one date in May, two in June, and one in August.

19. *Leptocephalus conger.*

May 14, 1914; 1; squid in stomach; two larval cestodes.

Conger eels were examined, most of them by Vinal N. Edwards, without finding squid as food or *P. loliginis* as a parasite, as follows: On one date in May, 6 fish; two dates in July, 3 fish; two dates in August, 2 fish; eight dates in September, 50 fish; four dates in October, 37 fish; one date in November, 1 fish.

Selachians in which the larval form, *Phyllobothrium loliginis*, was found were *Mustelus canis*, on three dates in May, one in June, and one in July; *Squalus acanthias*, on eight dates in May, two in June, one in July, and one in September; *Raja laevis*, on four dates in May; *Raja ocellata*, on nine dates in May and two in June. In no case had proglottides begun to develop. If either of these four species of selachians ever serves as the final host of this cestode the fact is not indicated by any of the data at hand. On the contrary, sufficient numbers of these hosts were examined in the months of July, August, September, October, and November without finding any adult cestode that could be linked up with this form to make it appear very improbable that *P. loliginis* can reach the adult stage in any one of these four selachians.

There is no reason whatever for thinking that *P. loliginis* ever attains maturity in any teliost. It seems, however, that this larval cestode can resist the digestive juices of a great variety of hosts for some time. Hence it doubtless often happens that, before this larval *Phyllobothrium* has reached a true final host, such, for example, as the mackerel shark, or maneater shark, it has sojourned for a shorter or longer time in the alimentary canal of one or more species of selachian, teliost, or squid. It will be noted that *P. loliginis* has been found in two species of squid on four dates in July and three in August; in four species of selachians on twenty-four dates in May, five in June, four in July, and one in September; in thirteen species of teliosts on fifteen dates in May, ten in June, and nine in July.

In my notes on the examination of fishes of the Woods Hole region I find records of squid as food in 45 species of fish in which *P. loliginis* was not found. In 10 of these species examinations were made in May, on seventeen dates; 4 species were examined in June, on six dates; 6 species were examined in July, on seven dates; 18 species were examined in August, on thirty-one dates; 19 species were examined in September, on thirty-five dates; 11 species were examined in October, on nineteen dates; 2 species were examined in November, on two dates.

The adult cestode which is described in this paper was found in but two hosts, *Carcharodon carcharias*, and *Isurus dekayi*, both belonging to the family Lamnidae, or mackerel sharks.

Evidence which points to *Phyllobothrium tumidum* as the probable adult stage of *P. loliginis* is based on the similarity in form and details of structure of the scolex. In making this comparison the terminal sucker of *P. loliginis* is interpreted to be an evanescent, larval structure, as in *Scolex polymorphus*.

The feature which presents the greatest difficulty is that part of the scolex which is posterior to the bothria. In *P. loliginis* there is a rather conspicuous neck portion which is sharply marked off from the strobile proper. In *P. tumidulum* the strobile appears to begin close to the bothria, although segments do not make their appearance at once. In the structure of the bothria and auxiliary suckers, and in the axial portion of the scolex, there is close agreement.

EXPLANATION OF PLATES.

ci, cirrus.
cp, cirrus-pouch.
ed, dorsal excretory vessel.
ev, ventral excretory vessel.
ga, genital aperture.
gd, germ duct.
lm, longitudinal muscle.
n, nerve.
o, ovary (germarium).
sd, sperm duct.
sg, shell gland.
t, testes.
u, uterus.
v, vagina.
vd, vas deferens.
vg, vitelline gland.
yd, vitelline duct.

Figures 1, 2, 4, 5, 7, 8, 11, 12, *Phyllobothrium tumidum* new species, from *Carcharodon carcharias;* figures 3, 6, 10, and 13 of the same, from *Isurus dekayi.*

PLATE 1.

FIG. 1. Scolex; dorso-ventral view; drawn from an alcoholic specimen. Actual diameter 2.1 mm.
2. Front view of scolex mounted in balsam; partly diagrammatic, folds, which partly covered the auxiliary suckers, having been omitted; greatest diameter 4.6 mm.
3. Single bothrium of scolex fixed while attached to mucous membrane of host, mounted in balsam; diameter of auxiliary sucker 0.35 mm.
4. Proglottides, 15 mm. from scolex; balsam; breadth 1.5 mm.
5. Posterior ends of three strobiles; balsam; length of longest 9 mm.
6. Transverse section of mature, but unripe, proglottis, a little in front of the genital aperture; greatest diameter 1 mm.

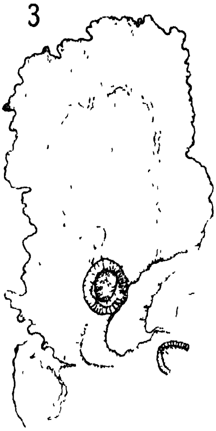
PLATE 2.

FIG. 7. Free proglottis, mature but unripe; balsam; length 5 mm. Sketch by George T. Kline.
8. Free, ripe proglottis; balsam; length 7.5 mm.
9. Diagram showing relation of ducts of reproductive organs in vicinity of the shell gland of *Phyllobothrium tumidum* new species.
10. Detail of longitudinal muscles in cross section, figure 6.

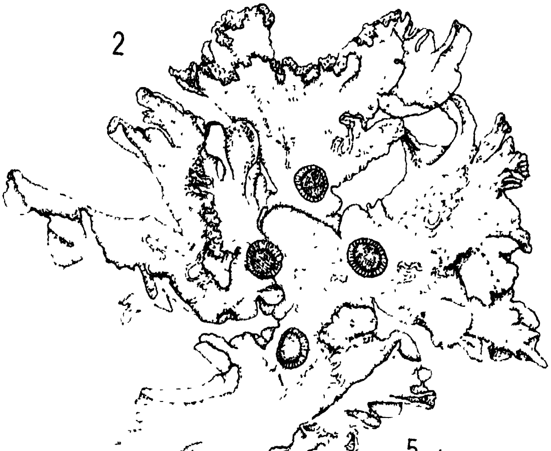
PLATE 3.

FIG. 11. Sagittal section, somewhat slanting, of anterior end of scolex, showing ganglion cells and exretory vessels; diameter of auxiliary sucker 0.25 mm.
12. Ganglion cells in sections of scolex. *a*, cells in parenchyma; *b*, black of bothrium, and cells associated with muscle fibers; *c*, wall of auxiliary sucker; *d*, cells and muscle fibers at base of pedicel; *e*, marginal region of bothrium; *f*, central region of bothrium; camera lucida drawings with Spencer No. 6 ocular, and 0.4 mm. objective.
13. Sagittal section of cuticle; see text.
14. Larval *Phyllobothrium* from swordfish; balsam; length 1.54 mm.
15. Larval *Phyllobothrium* from swordfish; much flattened at time of fixing; balsam; breadth of neck at base of scolex 0.75 mm.

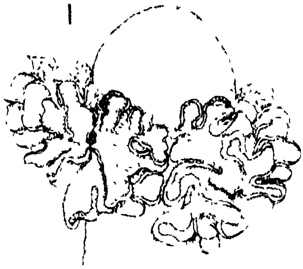
3



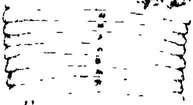
2



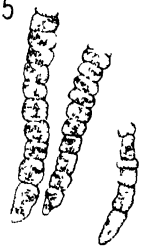
1



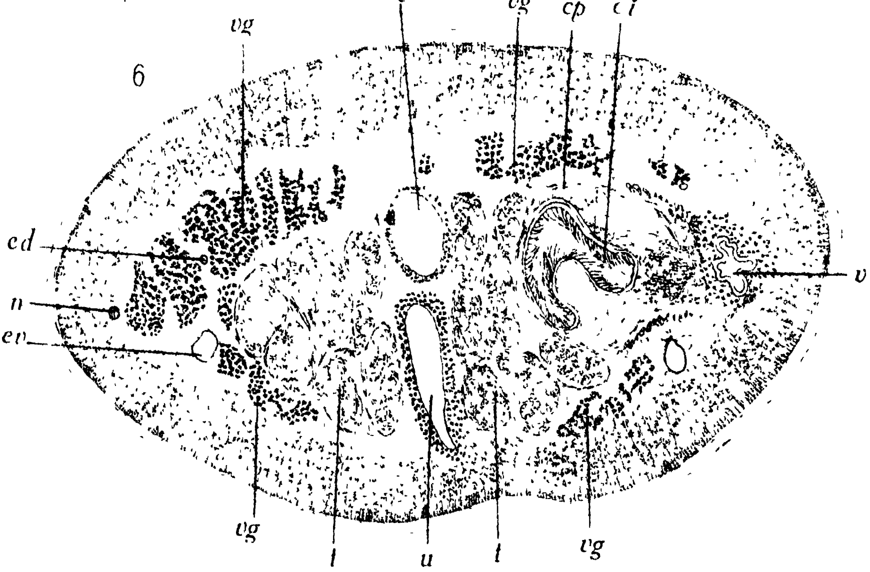
4



5

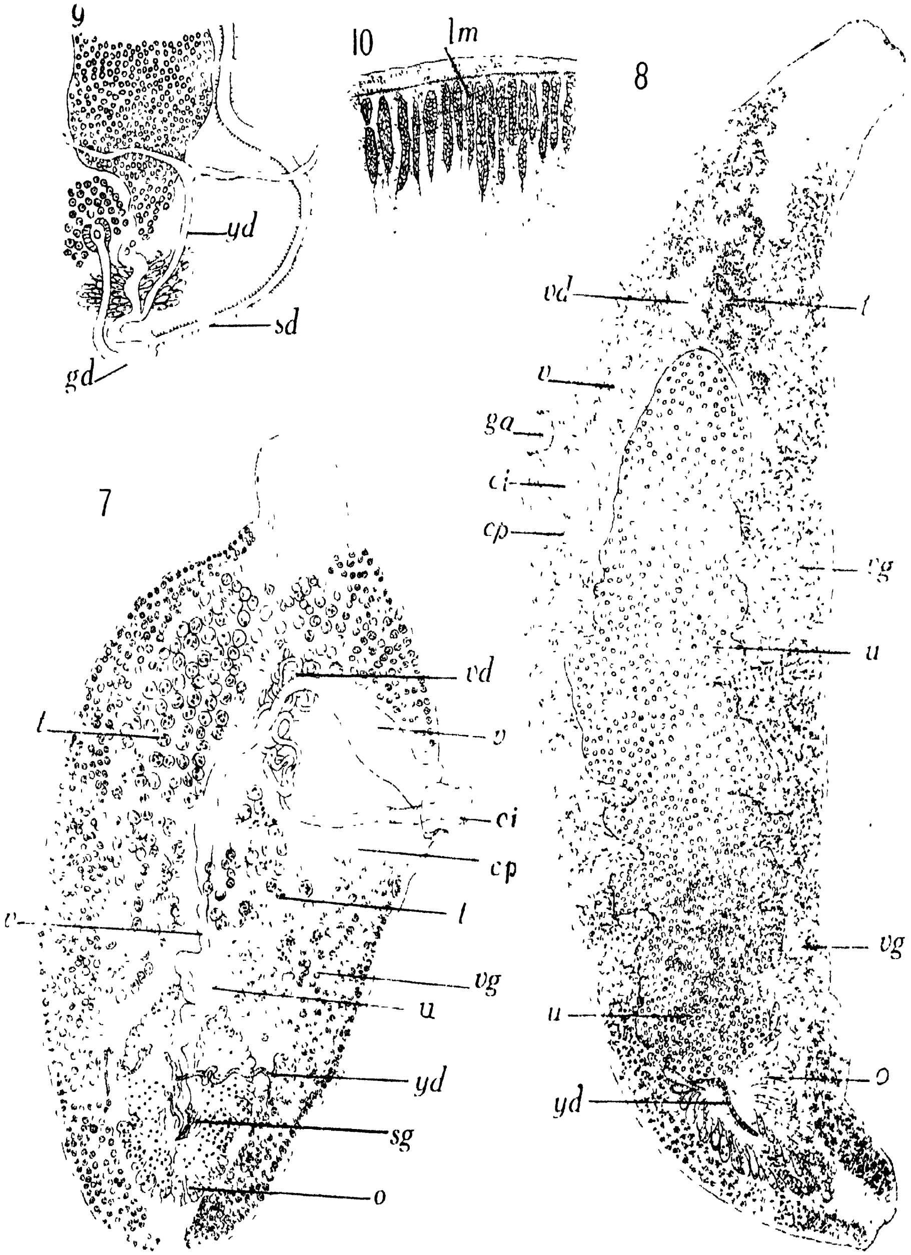


6



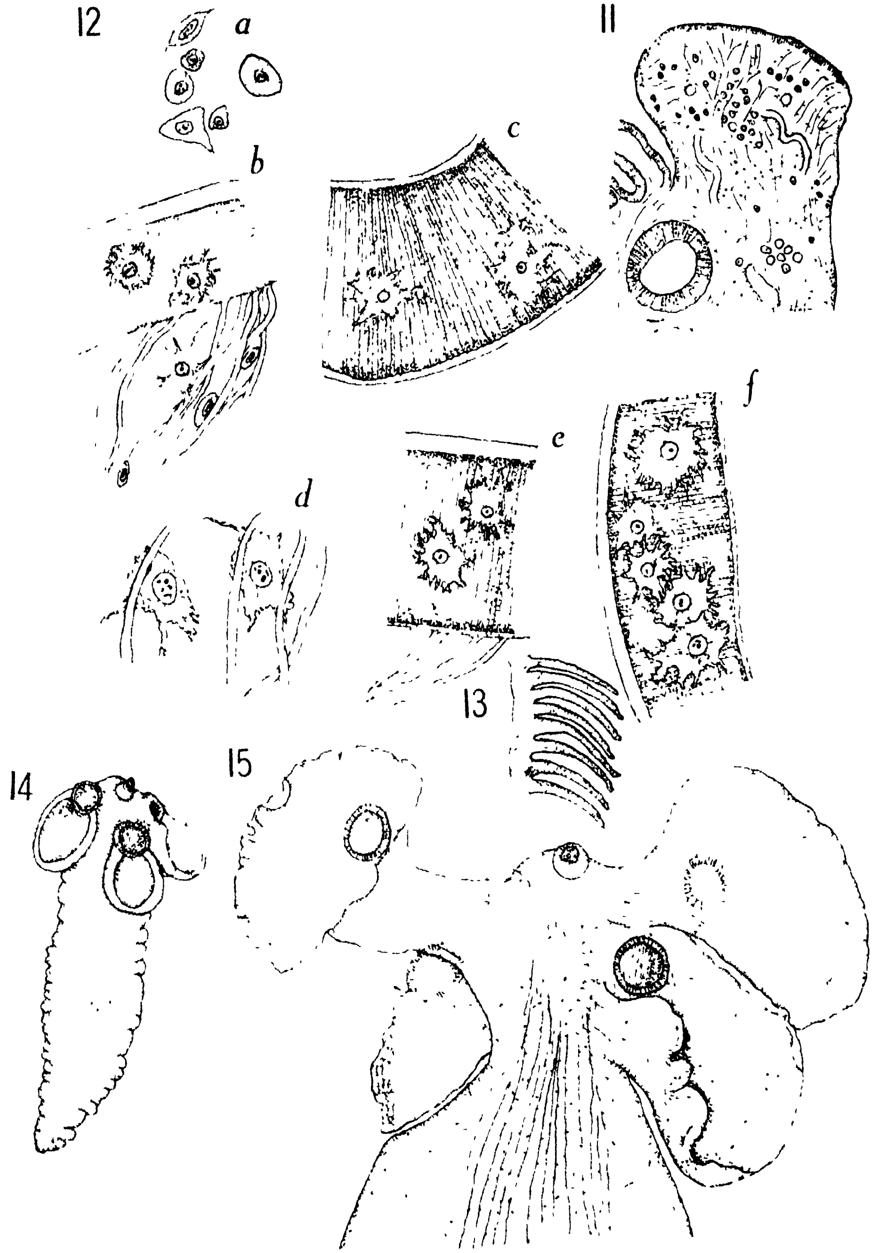
A NEW CESTODE, PHYLLOBOTHRIUM TUMIDUM.

FOR EXPLANATION OF PLATE SEE PAGE 16.



A NEW CESTODE, PHYLLOBOTHRIUM TUMIDUM.

FOR EXPLANATION OF PLATE SEE PAGE 18



A New Cestode, Phyllobothrium tumidum.

For explanation of plate see page 18.

ANTS FROM HONDURAS AND GUATEMALA.

By WILLIAM M. MANN,

Of the Bureau of Entomology, United States Department of Agriculture.

INTRODUCTION.

Most of the ants listed and described in this paper were collected by the writer during February and March, 1920, in Honduras, chiefly along the coast and in the near-by mountains between Ceiba and Tela. A few species from Guatemala, given to me by Prof. W. M. Wheeler, are included.

With the exception of *Eciton morosus*, var. *payarum* Forel, there are, as far as I can find, no previous records of ants from Honduras. The object of my visit was chiefly economic; not a great deal of time could be devoted to ant collecting and most of such time was spent in the deep woods overturning stones and logs, so the majority of the species noted are from these situations, and the collection therefore lacks many forms which would have been taken had more attention been paid to twig-dwellers and other tree-inhabiting ants.

Among the more interesting species described are a new *Thaumatomyrmex* and an *Acanthognathus*, both genera new to the Central American fauna and known before only by one South American species each, a new genus (*Opisthoscyphus*), related to *Alfaria*, and two aberrant myrmecines which I place, provisionally, in the genus *Stenamma.*

I am much indebted to the Vacarro Brothers of New Orleans and Ceiba, who furnished steamship passage from New Orleans to Ceiba and return, as well as transportation on their railroad in Honduras and accommodations at several of their plantations and to the officials of the United Fruit Company for similar courtesies and assistance on their estates.

Professor Wheeler kindly gave me the freedom of his collection for comparison and Professor Emery examined and compared with types in his collection several species of which I was doubtful.

DESCRIPTION OF SPECIES.

Subfamily CERAPACHINAE.

CERAPACHYS (PARASYSCIA) HONDURIANUS, new species.

Worker.—Length 2.75–3 mm.

Head one-fourth longer than broad, a little broader behind than in front, with slightly convex sides and broadly and shallowly concave posterior border. Antennal scapes short and thick, extending less than two-thirds the distance to occipital corners; funicular joints, except the terminal, transverse, terminal joint as long as the four preceding joints together. Thorax in profile very feebly convex; from above two and one-half times as long as broad, very slightly broader behind than in front. Petiole from above as broad as long; in profile a little higher than long, as broad in front as behind. Postpetiole about one-fourth broader than the petiole, narrower in front than behind.

Sublucid, the terminal funicular joints and the legs shining. Head and body coarsely and closely punctate and reticulate, the punctation of the head more coarse and dense than that of the thorax and abdomen.

Silky, erect pile scattered on head, body and appendages.

Color brownish red to dark brown, terminal joint of antennae and the legs lighter.

Female.—Length 4 mm.

Head somewhat shorter than in the worker. Eyes little convex, situated at middle of sides of head. Thorax nearly flat. Pronotum less than one-half as long as mesothorax. Scutellum much broader than long. Base of epinotum a little shorter than the declivity. Petiole from above distinctly broader than long.

Sculpture as in worker, except that the punctures of the mesonotum and scutellum are smaller and more separated, with the spaces between nearly smooth.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24432, U.S.N.M.

One small colony was taken beneath a stone.

This, the third American species of the subgenus *Parasyscia*, is very near *P. toltecus* Forel from Guatemala, but my specimens differ from cotypes in the National collection in having the antennal scapes thicker apically, in the proportionately broader petiole and in sculpture. In *toltecus* the punctures on the thoracic dorsum are much more sparse, and the space between is rather smooth and shining; in *hondurianus* they are larger and closer together and without smooth spaces between.

Subfamily PONERINAE.

PRIONOPELTA MAYRI Forel.

Honduras: Cecilia, San Juan Pueblo, Lombardia.

Occurs in small colonies in humid localities beneath stones or in rotten wood.

TYPHLOMYRMEX ROBUSTUS Emery.

Honduras: Cecilia, San Juan Pueblo, Lombardia.

The colonies are found beneath bark, where the workers run in file along narrow passageways, very similar to those of certain species of *Vollenhovia*.

Among individuals from the same colony is considerable variation in size, from 2.75 mm. to 4.25 mm. My workers, though smaller in size than the type specimens, appear otherwise identical.

GNAMPTOGENYS MORDAX (F. Smith).

Honduras: San Juan Pueblo.

The two colonies found were in partly rotten logs, nesting in burrows made by wood-boring insects. My workers agree with a Brazilian specimen from Emery's collection and differ from Smith's description in having the second gastric segment not striate, but regularly, sparsely, and rather coarsely punctate.

GNAMPTOGENYS REGULARE Mayr.

Honduras: Ceiba, Cecilia, San Juan Pueblo, Lombardia.

The commonest species of its genus in the districts visited. A favorite nesting site is beneath the bases of palm fronds.

GNAMPTOGENYS TORNATUM (Roger).

Honduras: Ceiba, San Pedro Sula.

GNAMPTOGENYS ANNULATUM Mayr.

Honduras: Cecelia, Lombardia, Tela.

GNAMPTOGENYS INTERRUPTUM Mayr.

Honduras: Lombardia.

One colony was found beneath bark on a rotting log.

THAUMATOMYRMEX FEROX, new species.

Worker.—Length 4.75 mm. (fig. 1).

Head distinctly broader than long and much broader in front than behind, sides in back of eyes and the posterior border rounded, sides in front of eyes projecting as lobes which are slightly shorter than the longitudinal diameter of the eye. Clypeus depressed and flat, broadly rounded anteriorly. Mandibles longer than the head, very slender and spiniform, at basal third with two very long spines, the first of which is swollen at base and slightly curved at tip, the second much longer than the first and feebly sinuate. Frontal carinae thick, moderately elevated and projecting forward beyond the anterior border of clypeus. Antennal scapes surpassing the occipital corners by a little less than one-third their length, bent at basal three-eighths, moderately thickened apically; first funicular

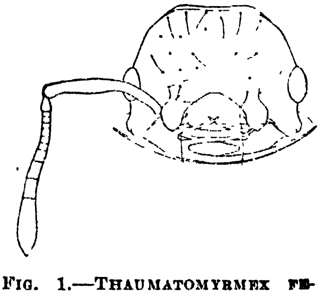


FIG. 1.—THAUMATOMYRMEX FEROX, NEW SPECIES. HEAD OF WORKER.

joint as long as the second and third together; joints 2–7 transverse; club very poorly defined, with the terminal joint nearly as long as the three preceding joints together. Eyes large and convex, situated in front of middle of sides of head. Pronotum broader than long, sides strongly convex, dorsum nearly flat. Promesonotal and mesoepinotal sutures strongly impressed. Mesonotum about one-fifth as long as pronotum, with moderately convex surface. Basal and declivous portions of epinotum equal in length, rounding into each other; the surface of the base broadly convex, of the declivity, flat. Petiole thick wedge-shape, higher than long, rounded above, anterior surface moderately convex, posterior surface flat. Gaster large and thick, longer than the thorax; sting short and thick. Legs not incrassate.

Shining, with fine punctures, each bearing a long and rather coarse hair, rather sparsely distributed on head and body and mandibles. Appendages with fine, short, recumbent hairs.

Color black; mandibles and antennae reddish brown, with the tips of the antennae lighter; anterior femora, except the bases and tips, apical halves of middle and posterior femora, the tips of the tibiae and all of the tarsi reddish brown, remainder of legs honey yellow.

Type locality.—Honduras: San Juan Pueblo.

Cotypes.—Cat. No. 24433, U.S.N.M.

Described from two workers that were taken with one larva and a pupa in a depression in a half rotten log near a stream in the forest. Though I searched intensively in this and in similar localities for more specimens I did not find the species again.

Th. ferox is the second species of this striking genus. *Th. mutilatus* described by Mayr from workers from Santa Catherina, Brazil, and since rediscovered in the same locality by Von Ihering has the head much longer in proportion to its breadth, the cheeks do not project, the mandibles are shorter with the spines less developed and the antennal joints are shorter. The structure of the thorax and abdomen in the two species is very similar.

HOLCOPONERA STRIGATA Norton.

Honduras: Lombardia.

OPISTHOSCYPHUS, new genus.

Worker.—Allied to *Alfaria* Emery.

Head subquadrate. Mandibles elongate, composed of a thickened near portion, on the inner side of which is a lamellate plate that gives the whole an elongate trigonal appearance. Clypeus short and broad, anterior portion horizontal, posterior portion broad, extending as an irregular impression between the frontal carinae but not separated from them by a suture. Frontal area strongly impressed, not definitely outlined. Frontal carinae short, their lobes well developed, flattened, longer than broad and broader than their distance apart, extending forward as far as the anterior border of clypeus; at sides somewhat bent inward, broadly covering the antennal insertions. Antennae 12-jointed, stout, the scape short, gradually thickened distally; funiculus thickened toward tip, with the terminal joint as long as the two preceding joints. Eyes distinct, but small and composed of few facets, situated at sides of head a little behind the middle. Thorax robust, without sutures above, unarmed, inferior angles of prothorax pointed; spiracles on sides of epinotal declivity very large. Petiole elongate, rounded, with a moderate-sized anteroventral tooth. Second gastric segment as long as the first and distinctly broader; remaining segments small and extending as a cone downward and forward. Tarsal claws simple. Anterior tibial spur strongly pectinate. Middle and posterior tibiae with a single very fine spur.

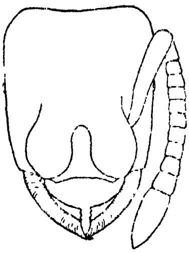


FIG. 2.—OPISTHOSCYPHUS SCABROSUS, NEW SPECIES. HEAD OF WORKER.

Genotype.—Opisthoscyphus scabrosus, new species.

OPISTHOSCYPHUS SCABROSUS, new species.

Worker.—Length, 2.75 mm. (figs. 2–3).

Head one-fifth longer than broad, a little narrowed in front, with nearly straight sides and posterior border and rounded occipital corners. Lamellate portion of mandibular blades at base with three small, separated denticles and anterior to these indistinctly denticulate. Antennal scapes extending four-fifths the distance to occipital corners; funicular joints 2–10 transverse, each larger than the preceding joint. Thorax little convex above, broadest in front of middle of pronotal region and somewhat constructed at sides between meso- and epi-notum. Petiole from above a little longer than broad, sides moderately convex; in profile broadly convex above, longer than high.

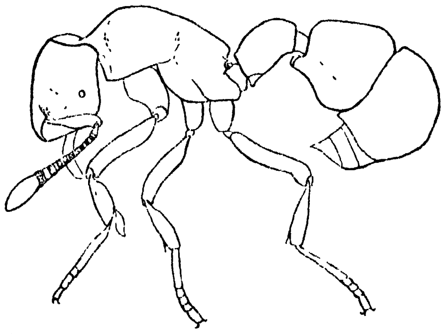


FIG. 3.—OPISTHOSCYPHUS SCABROSUS, NEW SPECIES. LATERAL VIEW OF WORKER.

Opaque, mandibles and appendages somewhat shining. Mandibles coarsely striate longitudinally. Head and body densely and rugosely punctate and with regular reticulae.

Hairs fine and silky, moderately abundant on head, body, and appendages; antennae and legs with coarser and longer hairs.

Color reddish brown, appendages lighter; hairs golden yellow.

Type locality.—Honduras: Lombardia.

Type.—Cat. No. 24434, U.S.N.M.

Described from a single worker that was found beneath a stone that sheltered also a small colony of *Cerapachys* (*Parasyscia*) *hondurianus.*

Because of the curious structure of the mandibles this species can not be included in the genus *Alfaria*, the workers of which have typical trigonal mandibles. The mandibles of *Opisthoscyphus* appear to be essentially linear, though the lamellate expansion at the apical half of the blades give them superficially an elongate-trigonal appearance. The two genera are similar in habitus, and the latter may possibly be later considered merely of subgeneric value.

ECTATOMMA (ECTATOMMA) TUBERCULATUM (Olivier).

Honduras:

Found in all wooded localities.

ESTATOMMA (ECTATOMMA) RUIDUM Roger.

Generally distributed and moderately common in all localities visited in Honduras.

PROCERATIUM MANCUM, new species.

Worker.—Length 2 mm.

Head a little longer than broad, slightly narrowed in front, sides a little convex; occipital corners broadly rounded, border feebly concave; median carinae fine, but distinct for entire length of front and vertex. Mandibular blades with six short, stout teeth. Clypeus between frontal carinae flat, more than twice as long as broad. Frontal carinae short and thin, moderately elevated and rounded posterior to middle. Antennal scapes narrowed basally and strongly incrassate at apical half, extending about two-thirds the distance to occipital corners, first funicular joint broader than long and a little longer than the second, remaining joints, except the terminal, strongly transverse, terminal joint as long as the four joints preceding. Eye at middle of sides of head, barely discernible. Thorax broadest at humeri, which are narrowly rounded, inferior angles obtusely angulate. Angle between base and declivity of epinotum with a strong broadly triangular spine; declivous surface concave above, flat beneath. Node in profile subquadrate, twice as high as long, with nearly straight anterior and posterior surfaces and slightly convex dorsum; from above, twice as broad as long, distinctly narrower than base of first gastric segment. Front of head coarsely punctate and less shining than the remainder of head and the thorax, which are more finely shallowly punctate.

Head, body, and appendages with abundant, fine, silky, semirecumbent yellow pilosity.

Color brownish red.

Female.—(deälated). Length 2.25 mm.

Similar in structure to worker, with the petiole a little shorter and thicker and the epinotal spines more blunt.

Type locality.—Honduras: Cecilia.

Type.—Cat. No. 24435, U.S.N.M.

Described from a single worker and one female found beneath a log.

This is the first species of the genus to be described from Central America. It is more closely related to *crassicorne* Emery, than to the more southern *croceum* Emery, differing from the former in its thicker and shorter petiolar node, more pronounced epininotal spines and in the much finer sculpture of the head and thorax.

PLATYTHYREA PUNCTATA F. Smith.

Honduras: Ceiba, San Juan Pueblo, Lombardia.

NEOPONERA VILLOSA (Fabricius), subspecies INVERSA (F. Smith).

Honduras: Ceiba.

One colony with larvae and pupae was found in a hollow log. Though able to sting severely, the workers are exceedingly timid.

NEOPONERA OBSCURICORNIS (Latreille), variety LATREILLEI Forel.

Honduras: Progresso, Carmelina, San Juan Pueblo, Ceiba, Choloma.

NEOPONERA APICALIS (Latreille).

Honduras: Lombardia, San Juan Pueblo.

NEOPONERA UNIDENTATA (Mayr).

Honduras: Lombardia, San Juan Pueblo, Progresso.

NEOPONERA CARINULATA (Roger), subspecies GIBBINOTA Forel.

Honduras: Lombardia.

NEOPONERA CRENATA (Roger).

Honduras: Ignacio.

Nesting in a hollow twig.

PACHYCONDYLA (PACHYCONDYLA) HARPAX (Fabricius).

Honduras: Progresso, Lombardia, Carmelina, Ceiba, Cecilia, San Juan Pueblo.

EUPONERA (NESOPONERA) CONSTRICTA (Mayr).

Honduras: San Pedro Sula, Cecilia, Progresso, Lombardia.

EUPONERA (TRACHYMESOPUS) CAUTA, new species.

Worker.—Length 3.25–3.50 mm.

Head a little longer than broad, slightly narrower in front than behind; sides feebly convex, occipital border shallowly concave. Mandibles with five rather stout, triangular teeth. Clypeus very broadly rounded at anterior border. Eyes distinct, flat, oval, their distance from anterior border of cheeks equal to one and three-fourths times their longitudinal diameter. Antennal scapes almost attaining occipital corners; first funicular joint as long as joints 2–3 together; second joint longer than broad, remaining joints gradually increasing in breadth; terminal as long as the two preceding joints together. Thorax much as in *cognata* Emery. Basal portion of epinotum a little longer than the declivity, the angle between the two surfaces narrowly rounded. Petiolar node high, little narrowed above, anterior surface convex, posterior surface flat; from above, very much broader than long.

Mandibles shining, with sparse and strong punctures and a few delicate striolae. Head and body densely punctate, the gaster moderately shining, head and thorax subopaque; legs and antennal scapes moderately shining. Erect hairs fine, white in color and sparse on head and thorax, more abundant on gaster. Pubescence not very thickly distributed on head, body, and appendages.

Color dark reddish brown to black; appendages lighter.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24436, U.S.N.M.

Described from several workers from a colony found in rotten wood.

This species is distinctly smaller in size than the other American species. It is most closely related to *cognata* Emery, which species is larger, darker in color, with shorter head, stouter antennal scapes, and larger eyes, and the mandibular blades are armed with seven teeth considerably larger than in *cauta.*

EUPONERA (TRACHYMESOPUS) STIGMA Fabricius.

Honduras: San Juan Pueblo, Ceiba.

PONERA PERPLEXA, new species.

Worker.—Length, 3.75–4 mm.

Head a little longer than broad, narrower in front than behind, sides slightly convex, posterior border broadly and shallowly concave. Mandibles stout, their blades with a series of small, closely set, irregular teeth, with two somewhat larger, near the tips. Eyes small, composed of four distinct facets, situated at anterior fourth of sides of head. Antennal scapes slightly surpassing occipital corners, first funicular joint a little shorter than the second and third together, joints 2–10 about as long as broad, terminal joint as long as the two preceding joints together. Pronotum as long as broad, sides and humeri broadly rounded. Mesoëpinotal suture distinctly, though narrowly, impressed. Basal portion of epinotum as long as the declivity, convex in front, flattened behind; declivity flat, obtusely margined at sides. Node in profile high, moderately narrowed above, anterior surface feebly convex, posterior surface flat; from above, strongly transverse, rounded at sides. Gaster rather stout.

Shining, finely and shallowly punctate throughout, with not very thick pruinose pubescence and very sparse, short, erect hairs on head and thorax, more abundant and longer on gaster.

Dark reddish brown to black; appendages and antennal funiculi lighter.

Type locality.—Honduras: Ceiba, Lombardia, Cecilia.

Cotype.—Cat. No. 24437, U.S.N.M.

Described from a small series from several colonies found beneath bark or stones.

In the form of the body this species closely resembles *P. foreli* Mayr from Brazil. It has, however, much smaller eyes than *foreli* and the pilosity is sparser. From *distinguenda* Emery it differs in the relatively broader mesonotum and in the finer sculpture of the head and body.

PONERA NITIDULA Emery.

Honduras: Ceiba, Progresso, Lombardia, Cecilia.

BELONOPELTA (BELONOPELTA) DELETRIX, new species.

Worker.—Length 4 mm. (fig. 4).

Head, excluding mandibles, longer than broad, broadest and with sides more convex in front of middle, posterior border feebly concave. Mandibles, when closed, crossing at middle, long, slender, and arcuate, the inner border at basal half with four strong, elongate teeth, the basal of which is the shortest, anterior edentate portion about as long as the dentate part, acute at tips. Clypeus strongly carinate at middle, triangularly projecting in front and terminating in a blunt spine. Antennal scapes almost attaining occipital corners, thickened at anterior half and with a distinctly concave outline on inner surface before the tip; funiculus stout, gradually thickened toward apex, first joint twice as long as broad, second a little longer than broad, joints 3–10 transverse, terminal joint conical, as long as the two preceding joints together. Eyes small and flat, situated at anterior sixth of sides of head. Thorax long, slender, and nearly straight in profile. Pronotum longer than broad and widest behind middle, sides convex. Mesonotum half as long as pronotum and broader than long. Base of epinotum flat, more than twice as long as broad and much longer than the declivity, from which it is separated by an obtuse angle; surface of declivity flat, sides obtusely margined. Petiole from above subcampanulate, sides little convex, posterior border broadly concave; in profile higher than long, a little higher behind than in front, not narrowed above, the broadly convex anterior surface rounding into the similarly convex dorsum; posterior surface shallowly concave, roundly margined at sides.

Body and appendages finely and very densely punctate and subopaque, the head in addition with coarser, separate and distinct punctures. Thorax with very sparse similar punctures. Clypeus with four coarse hairs at anterior margin, mandibles with sparse hairs, head, body and appendages with exceedingly fine pruinose pubescence.

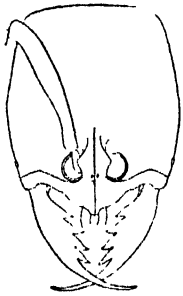


FIG. 4.—BELONOPELTA (BELONOPELTA) DELETRIX, NEW SPECIES. HEAD OF WORKER.

Black, antennae, mandibles and legs reddish brown.

Type locality.—Honduras: Choloma.

Cotypes.—Cat. No. 24438, U.S.N.M.

Described from two workers found beneath a log.

This species differs from *B. attenuata* Mayr in its shorter and broader head, the clypeus more projecting and narrowly rounded in front, the more slender and arcuate mandibles with much longer tips, the longer antennal scapes, smaller size and in having on the head coarser, separated punctures in addition to the dense and subtile punctation.

Both of these species differ markedly in the structure of the head from *curvata* Mayr, *pergandei* Forel, and *jeckylli* Mann and the latter three form a distinct group, of subgeneric value, which may be separated from typical *Belonopelta* as follows:

1. Head in profile elongate and narrowed in front. Frontal lobes small, not elevated, nearly parallel to front of head. Mandibles with several strong teeth, graduating in size. Sculpture fine________________**Belonopelta** Mayr.
Head in profile short and thick, subquadrate. Frontal lobes larger, elevated and vertical to front of head. Mandibles coarser, with one very large and one or more small teeth. Sculpture coarse______**Simopelta**, new subgenus.

BELONOPELTA (SIMOPELTA), new subgenus.

Genotype.—*Belonopelta* (*Simopelta*) *jeckylli* (Mann).

For characters see the above key.

LEPTOGENYS (LEPTOGENYS) GAGATES, new species.

Worker.—Length 4–4.5 mm. (fig. 5).

Head subquadrate, a little longer than broad, sides and occipital border nearly straight, occipital corners rounded. Mandibles slightly enlarged toward tips; apical border short and feebly concave. Clypeus sharply carinate at middle, median portion narrowly and weakly triangular, acute at tip, anterior border with broad, triangular teeth on either side of the median projection and closer to it than to the lateral border of head. Eyes slightly shorter than their distance to anterior border of head, composed of more than 30 facets. Antennal scapes surpassing occipital corners by less than one-third their length; first, second, and third funcular joints subequal in length and a little more than two times as long as broad, remaining joints, except the terminal, slightly longer than broad, terminal joint shorter than the two preceding together. Pro- and mesonotum together much shorter than the epinotum; pronotum little longer than broad; mesonotum strongly transverse, more than two times as broad as long and a little less than one-third as long as pronotum; epinotal base two times as long and rounding into the declivity, which is flat and dentate at lower third of sides. Petiolar node in profile a little higher than long, nearly as broad above as beneath, with the vertical anterior face rounding into the nearly straight dorsum, posterior face flat, rounding into the dorsum; from above a little longer than broad, broadest behind and slightly narrowing anteriorly.

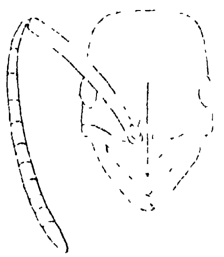


FIG. 5.—LEPTOGENYS (LEPTOGENYS) GAGATES, NEW SPECIES. HEAD OF WORKER.

Shining; sparsely, regularly and shallowly, though distinctly, punctate and pilose throughout.

Black; appendages reddish brown, the femora nearly black.

Type locality.—Honduras: San Juan Pueblo.

Cotypes.—Cat. No. 24439, U.S.N.M.

Described from four workers.

Near *L. venatrix* Forel, from which it differs in the shorter pro- and mesonotum (in *venatrix* the two together are as long as the metanotum) and in the shape of the petiole which in *venatrix* is nearly squamiform.

LEPTOGENYS (LEPTOGENYS) DONISTHORPEI, new species.

Worker.—Length 6.5 mm. (fig. 6).

Head a little longer than broad, slightly narrowed behind, sides and occipital border nearly straight, occipital corners broadly rounded. Mandibles of nearly equal width throughout; seen from the front, strongly bent at base, then nearly straight, apical border short and very feebly arcuate. Clypeus strongly carinate at middle, the median anterior lobe short and broadly rounded. Eyes large, as long as their distance from anterior borders of head. Antennal scapes surpassing occipital corners by less than one-third their length; second funicular joint about one-third longer than the first, third joint two times as long as broad, joints 4–10 gradually decreasing in length, terminal joint nearly as long as the two preceding joints together. Thorax a little narrower than the head, pronotum a little longer than broad and about three times as long as the mesonotum. Mesonotum oval and nearly as long as broad. Epinotum longer than pro- and meso-notum together, in profile nearly straight above, with the base twice as long as the declivity and broadly rounding into it. Petiolar node in profile as high as long, the anterior face vertical and rounding into the dorsal surface, which is convex and separated by an obtuse angle from the flat, vertical posterior face; from above a little longer than broad and gradually increasing in width from front to rear.

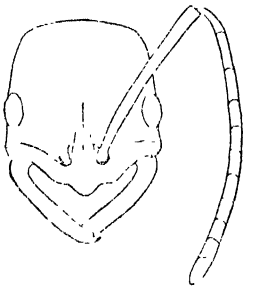


FIG. 6.—LEPTOGENYS (LEPTOGENYS) DONISTHORPEI, NEW SPECIES. HEAD OF WORKER.

Head, thorax and appendages moderately, gaster strongly, shining. Mandibles shining, delicately striolate longitudinally. Clypeus striolate. Head in front with longitudinal striae, which are finest and more dense on cheeks and immediately inward from the eyes and coarser and more irregular medially; vertex and occiput with shallow foveolate punctation and subreticulate striae. Pronotum and epinotum finely and densely striate transversely, the pronotum with a median area where the striae are very obscure and with several coarse punctures. Mesonotum with sparse longitudinal striae. Petiolar node with sparse and coarse punctures and subreticulate striae. Gaster regularly punctate. Appendages densely, finely, and shallowly punctate.

Hairs abundant, moderately long and suberect. Legs with short, recumbent hairs in addition to longer suberect ones.

Black; tip of gaster and the appendages brownish red.

Type locality.—Honduras: Lombardia; Cecilia.

Cotypes.—Cat. No. 24440, U.S.N.M.

This species, which is dedicated to the English myrmecologist, H. St. John Donisthorpe, is related to *L. wheeleri* Forel. The latter species differs in its relatively longer head and antennal scapes and in sculpture, the entire body being densely punctate and opaque.

LEPTOGENYS (LOBOPELTA) HONDURIANA, new species.

Worker.—Length 10 mm. (fig. 7).

Body rather robust. Head a little longer than broad and broader in front than behind, with nearly straight sides, broadly rounded corners and very feebly convex occipital border. Eyes situated in front of sides of head, large, slightly shorter than their distance to front border of head. Mandibles with distinct basal and apical borders separated by a prominent, rounded angle, apical border distinctly concave at basal third, then very broadly convex and at apical third feebly concave. Clypeus carinate at middle, the anterior por-

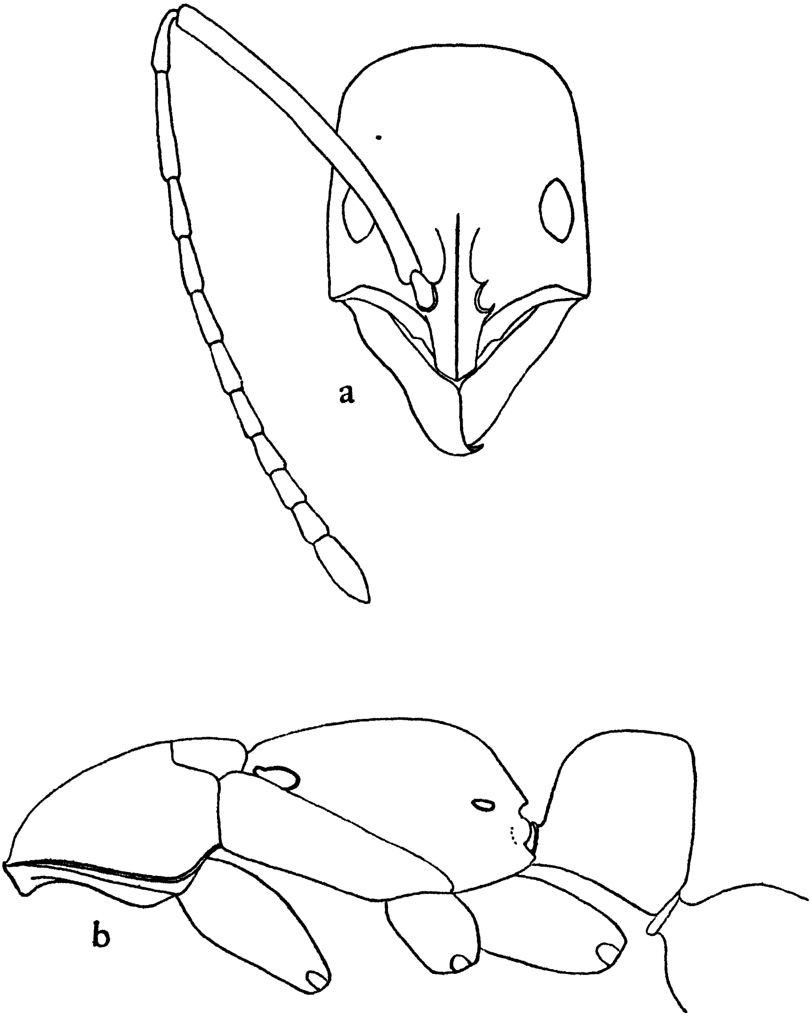


FIG. 7.—LEPTOGENYS (LOBOPELTA) HONDURIANA, NEW SPECIES. *a*, HEAD OF WORKER; *b*, THORAX AND PETIOLE.

tion broad, filling the area between the closed mandibles, apex broadly triangular. Antennal scapes surpassing occipital corners by two-sevenths of their length, second funicular joint nearly as long as the third and fourth together, third joint two and one fourth times as long as broad, remaining joints decreasing in length apically, terminal joint slender, slightly shorter than the two preceding joints together. Pronotum in profile moderately convex; from above longer than broad and less than three times as long as mesonotum. Mesonotum a little longer than broad. Epinotum as long as the pro and mesonotum together, its base in profile rather convex above and broadly rounding into the short, flat declivity. Petiolar node in profile higher than long, slightly higher behind than in front, broadly convex above and rounding into the steep, convex anterior surface and more narrowly into the flat posterior surface; from above, less than twice as long as broad, and evenly narrowed toward the front.

Head, thorax and petiole nearly opaque; densely and coarsely punctate and with striolae, longitudinal on the head and transverse on epinotal base. Mandibles very subtilly striate and with coarse, scattered punctures. Clypeus and front of head irregularly, longitudinal striate. Gaster and legs with regular, moderately coarse, shallow, separated punctures.

Erect hairs long, fine and moderately abundant on head, body and appendages; short, recumbent, silky hairs everywhere, but thickest on gaster.

Color black, mandibles, funiculi, legs and tip of gaster reddish.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24441, U.S.N.M.

Described from a series of eight workers.

In the strong punctation, which on the pronotum is unusually coarse, almost reticulate, the species resembles *L. mexicana* Mayr, which differs in its much smaller size and in the structure of the mandibles, which have the apical border evenly concave instead of biconcave as in *honduriana*.

LEPTOGENYS (LOBOPELTA) RUFA, new species.

Worker.—Length, 2.9 mm.

Head one-fifth longer than broad, subquadrate, nearly as broad behind as in front, sides feebly convex, posterior border straight. Mandibles little curved, linear to their apical border, which is very short and feebly concave and separated from the basal portion by an obtuse angle. Clypeus sharply carinate, triangularly produced in front and not occupying the entire area between the closed mandibles. Eyes small, situated at sides of head, at a distance from front of head equal to two times their longitudinal diameter. Antennae stout, arcuate, their scapes surpassing occipital corners by about one-fourth their length; funicular joints one-third longer than broad, the rest except the terminal as broad or slightly broader than long. Pronotum longer than broad, little convex above. Mesonotum transverse. Epinotum as long as pro and mesonotum together, base in profile slightly convex, declivity flat, obtusely margined at sides on upper half, the margins terminating as stout, blunt spines. Petiolar node in profile higher than long, as broad above as below, with abrupt anterior and posterior faces and broadly convex dorsum; from above, distinctly broader than long and only slightly narrower in front than behind. Gaster and legs rather stout.

Strongly shining. Finely punctate throughout and with moderately abundant fine erect hairs.

Color ferruginous.

Type locality.—Honduras: Ceiba.

Cotypes.—Cat. No. 24442, U.S.N.M.

Described from one worker.

The small size, robust form, stout antennae and dentate sides of the epinotal declivity are similar to those characters in *L. pusillus* Emery, which differ from *rufa* in having the head elongate, the petiole longer than broad and in color.

LEPTOGENYS (LOBOPELTA) CONSANGUINEA Wheeler.

Honduras: San Juan Pueblo.

A single worker taken beneath leaves on the ground agrees closely with cotypes in the Wheeler collection.

LEPTOGENYS (LOBOPELTA) IMPERATRIX, new species.

Worker.—Length, 10 mm. (fig. 8).

Head elongate, constricted behind to about half its width at clypeus, sides little convex. Eyes large and convex, nearly as long as their distance from the anterior border of head. Mandibles rather broad, the basal and apical borders separated by a rounded angle; apical border evenly concave. Clypeus carinate at middle, the anterior median portion filling the space between the closed mandibles, sides nearly straight, anterior border subtruncate. Antennae very long; scapes surpassing occipital corners by about half their length; second funicular joint much longer than the third, third joint nearly five times as long as broad, remaining joints gradually decreasing in length, the penultimate two and a half times as long as broad and the terminal shorter than the two preceding joints together. Thorax at broadest point a little narrower than the head, pronotum longer than broad, mesonotum less than a third as long as pronotum. Epinotum distinctly longer than pro and mesonotum together, in profile the nearly straight base broadly rounds into the short declivity. Petiolar node strongly compressed, in profile longer than high, more than twice as high behind as in front, the anterior and porterior face declivous and nearly flat; from above two and a half times as long as broad, slightly constricted behind and very strongly so in front. Gaster and legs long and slender.

Very feebly shining. Mandibles more shining, coarsely, though shallowly, and sparsely punctate. Clypeus with irregular, longitudinal striae, the head and body cribrately punctate, the epinotum rugosely and densely punctate and in addition with transverse striolae, especially noticeable on the declivous portion. Appendages rather densely, shallowly punctate and more shining than the rest.

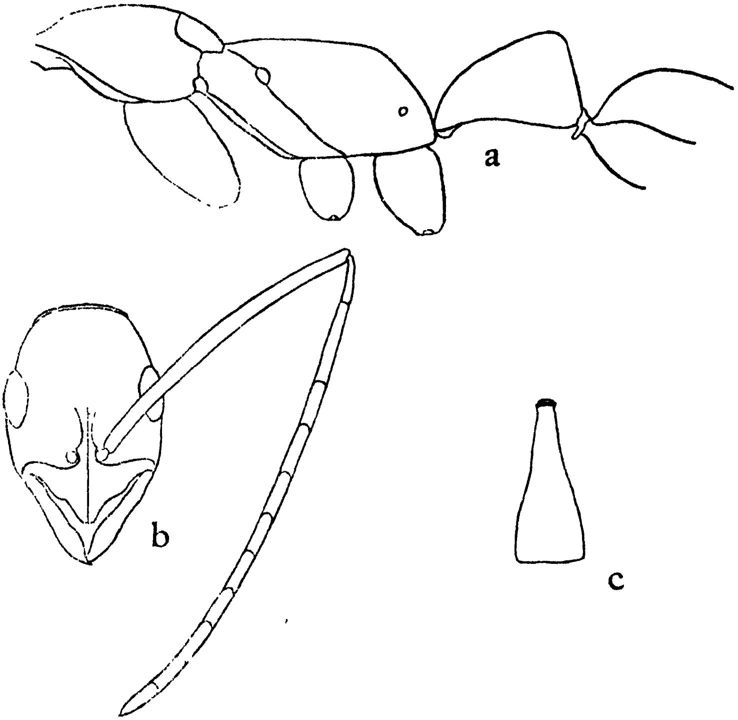


Fig. 8.—Leptogenys (Lobopelta) imperatrix, new species. Worker. a, Thorax and petiole; b, head; c, petiole from above.

Head and body with exceedingly sparse, long, erect hairs and short semirecumbent hairs which are moderately abundant on head and thorax and more dense on the gaster. Appendages with scattered erect hairs and abundant, shorter semirecumbent ones.

Color black, with a purple reflection, which is especially rich and deep on the sides of the compressed, smooth, anterior part of the petiolar node; mandibles, funicules, trochanters, tips of femora and tibiae, the tarsi and apex of gaster reddish brown.

Female.—Length 10 mm.

Differing from the worker in having the petiolar node much shorter, in profile a little higher than long and more convex above, and in the enlarged gaster.

Type locality.—Honduras: Lombardia, San Juan Pueblo.

Cotypes.—Cat. No. 24443, U.S.N.M.

Described from a series of workers and one female taken in rotten wood and beneath logs.

In its elongate slender form, constricted head and the large size of the eyes *imperatrix* resembles *famelica* Emery from Costa Rica. The latter species, however, has the petiole shorter and much less constricted in front (seen from above), the anterior portion of the clypeus is broader and the mandibles differently shaped, the sculpture is different and the gaster, judging from Emery's description, lacks the rather dense, almost pruinose covering that occurs in *imperatrix*.

ANOCHETUS (ANOCHETUS) MINANS, new species.

Worker.—Length, including mandibles, 3.5 mm.

Head broad, deeply incised behind, posterior corners narrowly rounded, sides concave posterior to eyes, bluntly angulate outward from eyes and bisinuate in front. Mandibles much shorter than head, anterior two-thirds thickened, inner surface of blades swollen at middle, edentate, terminal teeth stout, rather blunt at tips, the basal thicker and shorter than the last, the second half as long as the apical. Frontal carinae extending to opposite posterior borders of eyes, more elevated than in *mayri* Emery. Eyes small, with 6–7 large facets. Antennal cavities large, bordered outwardly by a thickened carina stronger than in *mayri* and roundly angulate at anterior third. Antennal scapes not attaining occipital corners; first funicular joints as long as the second and third together, joints 2–7 elongate, but a little less than twice as long as broad, joints 8–10 twice as long as broad, terminal joint slender, acute, slightly shorter than the three preceding joints together. Pronotum, excluding frontal narrowed portion, as long as broad, widest at posterior half. Meso and epinotum as in *mayri* but the epinotal spines are coarser and more rounded at tips. Petiolar node in profile a little thicker than in *mayri* and above more shallowy concave, with the lateral points shorter and less acute.

Moderately shining. Mandibles finely punctate and sparsely pilose. Head in front densely striated longitudinally, at sides obliquely striate, punctate behind. Pronotum at sides with longitudinal striae and punctures, disk finely punctate. Epinotum rugulose-punctate. Petiolar node superficially striate at base. Gaster finely and regularly punctate.

Head, body, and appendages with rather sparse, recumbent pile. Erect, coarser hairs scattered on head and thorax, more abundant on gaster.

Light brownish yellow, apical half of gaster dark brown, mandibles brownish red.

Type locality.—Honduras: Lombardia.

Type.—Cat. No. 24444, U.S.N.M.

This species is described from a single worker close to *A. mayri* Emery, but differs in its much smaller eye, feeble sculpture and in color, in addition to the characters mentioned in the above description which separate it also, except in color, from *mayri*, var. *neglectus* Emery from Brazil.

ODONTOMACHUS CHELIFER (Latreille).

Honduras: Choloma, Progresso.

One colony found in débris at the foot of a tree in dense forest.

ODONTOMACHUS HAEMATODA (Linnaeus).

Honduras: Choloma.

ODONTOMACHUS HAEMATODA (Linnaeus), subspecies LATICEPS Roger.

Honduras: Progresso.

ODONTOMACHUS HAEMATODA (Linnaeus), subspecies DULCIS, new subspecies.

Worker.—Length (including mandibles) 8 mm.

Differing from typical *haematoda* in the following characters:

The size is smaller, the tegument nearly opaque, with the striation of the head and thorax proportionately coarser; gastric segments 1–3 are densely striato punctate and subopaque; the petiole, seen from the front, is distinctly broader and more narrowly rounded at sides; the color is dark brown, with the petiole and legs yellowish and the mandibles and antennal scapes reddish.

Type locality.—Honduras: Progresso.

This is a very distinct subspecies, resembling subspecies *laticeps* but is much smaller, differently colored and with the petiole broader and more convex at sides (seen from the front).

ODONTOMACHUS HAEMATODA (Linnaeus), subspecies STRIATIVENTRIS Emery.

Honduras: San Juan Pueblo, Choloma.

Subfamily DORYLINAE.

CHELIOMYRMEX MOROSUS (F. Smith).

Honduras: Cebia.

Two intermediate workers were taken from a small colony uncovered by turning a stone. The others disappeared in the ground and could not be again located. In habitus, as well as in the locality where it is found, this species is similar to *Eciton coecum* and liable to be mistaken for it in the field and neglected by the collector.

ECITON (ECITON) BURCHELLI (Westwood), variety INFUMATUM Wheeler.

Honduras: Carmelina, Lombardia, San Juan Pueblo, Choloma.

A common species, frequently seen crossing paths and sometimes raiding dwelling and storehouses.

ECITON (ECITON) HAMATUM (Fabricius).

Honduras: San Juan Pueblo.

Less common than the preceding species.

ECITON (LABIDUS) COECUM (Latreille).

Honduras: Carmelina, San Juan Pueblo, San Pedro Sula.

Frequently found in the banana fields beneath fallen stalks.

ECITON (LABIDUS) PRAEDATOR F. Smith.

Honduras: Lombardia.

One large file in the woods was accompanied by several species of conopid flies of the genus *Stylogaster* which followed them evidently in order to oviposit on the worker ants.

ECITON (ACAMATUS) IMPUDENS, new species.

Worker.—Length 3.25–6.50 mm. (fig. 9).

Head longer than broad and a little broader in front than behind, sides little convex, posterior corners narrowly rounded, border feebly concave. Frontal carinae nearly straight, in profile slightly elevated and rounded. Mandibles at basal two-thirds with a series of five irregular blunt teeth. Anterior margin of clypeus nearly straight. Antennal scapes extending nearly four-fifths the distance to occipital corners, moderately stout; second funicular joint as long as the third and longer than the first, all the joints longer than broad, thickest apically, terminal joint shorter than the two preceding together. Eye very distinct, convex. Pro-mesonotum about three times as long as broad, evenly convex above. Base of epinotum nearly flat, broadly rounding into the declivity. Petiole as broad in front as behind, twice as long as broad, in profile slightly longer

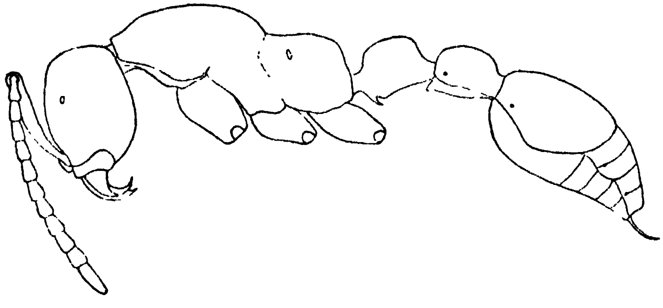


FIG. 9.—ECITON (ACAMATUS) IMPUDENS, NEW SPECIES. WORKER.

than broad, feebly convex above, armed anteroventrally with an acuminate spine, which curves backward. Postpetiole a little longer than broad, moderately convex above.

Head with sparse, fine punctures, strongly shining. Mandibles coarsely striate. Thorax and epinotum granulosely punctate and subopaque; sides of pronotum obscurely striolate. Petiole and postpetiole similarly but very feebly sculptured. Gaster and legs and scapes shining; funiculus subopaque.

Very fine and silky, long, erect yellow hairs scattered on head, body, and appendages.

Brownish yellow, gaster lighter than the rest.

Type locality.—Honduras: Progresso.

Cotypes.—Cat. No. 24446, U.S.N.M.

Described from workers of an army that swarmed upon me while I was sitting on the ground in the forest examining a Pheidole nest. The sting is temporarily painful, but the effects of short duration.

E. impudens is near *E. alfaroi* Emery, described from Costa Rica, which differs in having the thorax flatter, the head longer and more pointed at the occipital corners, in lacking the distinct eyes, in the widely separated, coarse punctation of the pro-mesonotum, the more elongate and coarsely sculptured epinotal base and in the shorter and triangular anteroventral spine on the petiole.

The distinct eyes, the sharp anteroventral petiolar spine, the strongly shining head and the bright color of *impudens* make it an easily recognizable species.

Subfamily PSEUDOMYRMINAE.

PSEUDOMYRMA GRACILIS (Fabricius).

Honduras: San Pedro Sula.

PSEUDOMYRMA GRACILIS (Fabricius), variety MEXICANA Forel.

Honduras: Tela.

PSEUDOMYRMA CAROLI Forel.

Honduras: San Pedro Sula.

In Bull's Horn Acacias.

PSEUDOMYRMA DISTINCTA F. Smith, variety PULCHELLA Forel.

Honduras: Tela.

One worker of this beautiful little species was found on a leaf.

Subfamily MYRMECINAE.

STENAMMA DIVERSUM, new species.

Worker.—Length, 2.25 mm.

Head a little longer than broad and slightly narrowed in front, sides in front nearly straight; occipital corners very broadly rounded; occipital border shallowly concave. Mandibles thick, their blades with three strong teeth on apical half and three short, blunt teeth on posterior half. Clypeus nearly flat between frontal lobes, short and very moderately convex in front, indistinctly bicarinate at middle, anterior border broadly rounded. Frontal lobes small, but prominently elevated; frontal carinae acute, slightly divergent, extending beyond opposite posterior borders of eyes. Antennal scapes barely surpassing occipital corners; first funicular joint nearly as long as the following three joints together; joints 2–8 strongly transverse; last four joints longer than broad and forming a rather slender club, terminal joint shorter than joints 9–10 together. Eyes situated at sides of head, well in front of middle, convex, much shorter than their distance from anterior border of head. Thorax robust, though narrower than head. Pronotum in profile convex, inferior corners subangulate; from above, a little longer than broad with moderately convex sides and rounded humeri. Mesoepinotal impression strong. Epinotal base straight in profile, about as long as the declivity, with a pair of triangular spines which are longer than their distance apart at base, divergent and directed upward and backward. Petiole elongate, the peduncle much longer than the node, which in profile is higher than long and rounded above, and from above strongly transverse and narrowly rounded at sides. Postpetiole rounded, as broad as, but distinctly lower than, the petiole. Gaster very broadly oval. Legs rather stout.

Shining. Mandibles coarsely and shallowly punctate and striate. Cheeks coarsely and irregularly striate; remainder of head and the gaster smooth. Thorax and epinotal base strongly, reticulately costate. Petiolar peduncle superficially punctate, node smooth. Postpetiole smooth above, at sides with sparse and coarse punctures. Legs shining.

Fine very long and erect yellow hairs abundant on head and body, shorter on appendages.

Jet black; appendages brownish red, with the femora and tibiae strongly infuscated except at bases and tips.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24447, U.S.N.M.

Described from two workers collected beneath a stone.

This species strikingly resembles some of the species of *Pristomyrmex* in its sculpture, it is like a small *Rogeria* in habitus and in having the inferior prothoracic corners angulate, but because of the 4-jointed antennal club and the structures of the head I have placed it in *Stenamma*, with doubt.

STENAMMA FELIXI, new species.

Worker.—Length 3.75 mm. (fig. 10).

Head a little longer than broad and as broad in front as behind, sides feebly convex, occipital corners rounded, border straight. Mandibles thick, their blades with four short and broad triangular teeth. Clypeus but little convex anteriorly, its border narrowly and very feebly concave at middle. Frontal lobes little elevated, narrow; the carinae short, bordering the antennal fossae behind. Antennae short and stout, scapes attaining occipital corners; first funicular joint nearly as long as the three following joints; joints 2–6 transverse, joint seven about as long as broad, joints 8–11 longer than broad, together forming a club much longer than the remainder of funiculus; with the terminal joint a little shorter than the two preceding joints together. Eyes moderate in size, not very convex, situated at sides of head well in front of middle. Thorax robust. Promesonotal suture discernible but feeble and not interrupting the sculpture. Promesonotum evenly but weakly convex above, humeri rounded. Meso-epinotal suture deeply, but not broadly impressed. Epinotum entirely unarmed, the base more than twice as long as broad and longer than the flat, sloping declivity; border of declivity margined at base by thin, ear-shaped projections. Petiole with a long, slender peduncle, node subconical, narrowly rounded at top. Postpetiole elongate, shorter, and a little broader than the petiole, longer than broad, broadest behind middle; in profile, rather strongly convex above. Legs rather stout.

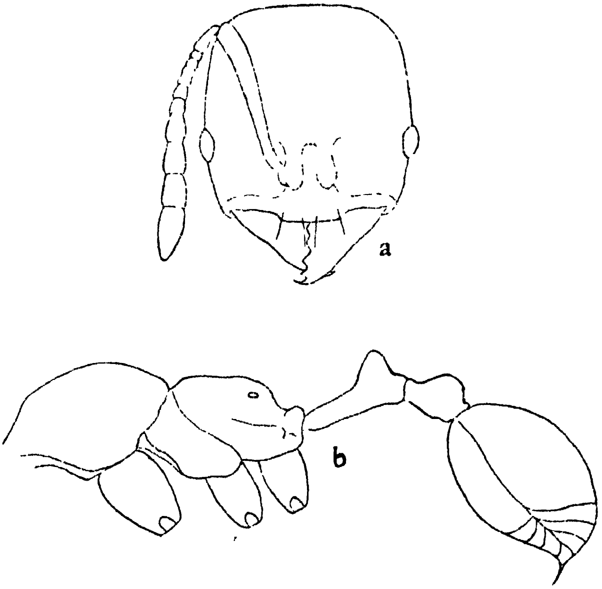


FIG. 10.—STENAMMA FELIXI, NEW SPECIES. WORKER. *a*, HEAD; *b*, THORAX AND ABDOMEN.

Gaster shining, the rest slightly shining. Mandibles shining, striate at base and sparsely punctate elsewhere. Head densely punctate and with striae which are longitudinal and straight at middle of front and tortuous and reticulate on sides and occiput. Thorax coarsely reticulately striate, the striae more transverse on the mesothorax. Base and declivity of epinotum transversely striate. Petiole finely and superficially punctate. Gaster with sparse, fine punctures. Antennal scapes rugulose. Legs finely punctate.

Fine, erect, rather stiff hairs moderately abundant on head and body. Antennae and legs with sparse pubescence, the legs with a few longer semiappressed hairs.

Black; appendages dark brown.

Type locality.—Honduras: San Juan Pueblo. (Several specimens on orchids from Jalapa, Mexico, taken in quarantine at Washington are apparently identical with the cotypes.)

Cotypes.—Cat. No. 24448, U.S.N.M.

Described from six workers.

This species, which is dedicated to Don Felix Vacarro, of Ceiba and New Orleans, and the preceding species are aberrant in the structure of the antennae, but otherwise have the characters of the genus *Stenamma.*

APHAENOGASTER (DEROMYRMA) HONDURIANA, new species.

Worker.—Length, 3.75–4 mm. (fig. 11).

Head elongate, broadest in front, sides little convex; occiput narrowed, with the border reflexed. Mandibles large, pointed at tips, the blades with five short, broadly triangular teeth, the apical of which are larger than the others. Clypeus moderately convex, broadly rounded at anterior border. Frontal lobes narrow; carinae feeble, extending to opposite middle of eyes. Antennae slender, the scapes extending half their length beyond the occipital corners; funicular joints 2–7 about twice as long as broad; joints 8–11, much longer and a little thicker, forming an elongate club, which is somewhat longer than the remainder of the funiculus. Eyes large and convex, situated a little in front of the middle of head. Thorax slender. Pro-mesonotum in profile evenly arcuate above, except the posterior fifth, which is rather flat and sloping toward the strong mesoepinotal impression. Epinotum in profile with the base flat, nearly two times as long as the declivity and separated from it by an obtuse angle, feebly dentate at the corners. Peduncle of petiole as long as the node, which is highest in front, flat and sloping dorsally and short and sloping behind. Postpetiole slightly shorter than the petiole, evenly convex in profile; from above more than two times as broad as the petiole, narrowed in front, broadest behind middle. Gaster elongate oval. Legs long, the femora slightly thickened in front of middle.

Body and legs moderately shining. Mandibles moderately shining, coarsely striate. Head with dense, cribrate punctures and a few wavy striae, which are longitudinal on the front and oblique on the cheeks. Pronotum with extremely shallow punctures. Mesonotum punctured more coarsely than the pronotum and its posterior portion rugulose. Base of epinotum irregularly, transversely striate. Petiole, postpetiole, and gaster very shallowly punctate, similar to the pronotum. Legs finely and densely punctate.

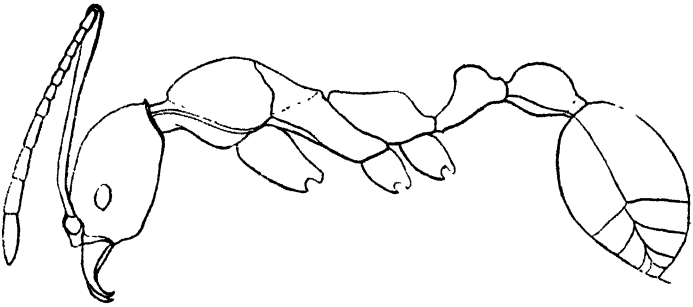


FIG. 11.—APHAENOGASTER (DEROMYRMA) HONDURIANA NEW SPECIES. WORKER.

Head and body with stiff and blunt erect black hairs. Flexor margins of femora with a row of similar hairs. Antennae and legs sparsely pubescent.

Color dark brown to black. Antennae and legs brown.

Female.—(deälated). Length 4 mm. Mesothorax slightly convex in profile. Scutellum one-fourth broader than long, suboval. Epinotal spines coarser than in worker.

Mesothorax rugosely punctate and with short, irregular carinae. Sculpture, pilosity, and color as in worker.

Type locality.—Honduras: Lombardia, San Juan Pueblo.

Cotypes.—Cat. No. 24449, U.S.N.M.

Described from one female and many workers taken from a number of colonies found in rotten wood, where it resembled in nesting habits and habitus *Megalomyrmex silvestrii* Wheeler.

A. honduriana is much smaller than the other Central American Aphaenogasters and is characterized by the short neck, the elongate antennae with four-jointed club, by the sculpture and color.

There is, in the series before me, some variation in sculpture and in the degree of the angle between the base and declivity of the epinotum, which in some workers is very finely dentate at the sides and in the others roundly angulate.

APHAENOGASTER (DEROMYRMA) PHALANGIUM Emery.

Honduras: San Pedro Sula.

Several colonies found in canons near the city were beneath stones near streams. This species is "mimicked" by a spider and an Alydid bug, both of which I found only in the same locality as the ants.

PHEIDOLE (ELASMOPHEIDOLE) HONDURENSIS, new species

Soldier.—Length 3.10 mm. (fig. 12).

Head, excluding mandibles, one and one-third times as long as broad, slightly broadest in front; sides nearly straight, occipital corners broadly rounded, occipital border rather strongly concave; vertex with a narrow and deep median sinus. Mandibles short and thick, blades concave, armed with a pair of coarse, blunt teeth at apex, and several very small and blunt teeth at middle. Clypeus elongate, triangular, circularly impressed at middle and behind, nearly straight at anterior border. Frontal carinae short, not extending posterior to antennal fossae, their lobes thin and elevated; from the side, projecting as triangular spines. Antennae short and rather slender; scapes somewhat flattened at base, extending a little less than half the distance to occipital; first funicular joint distinctly longer than the second and third joints together, third joint about as broad as long, joints 4–8 gradually increasing in length, those apically distinctly longer than broad; club 3-jointed, about as long as remainder of funuculus, joints longer than broad, with the terminal as long as the other two together. Eyes rather large, feebly convex, situated at anterior third of sides of head. Thorax about half as

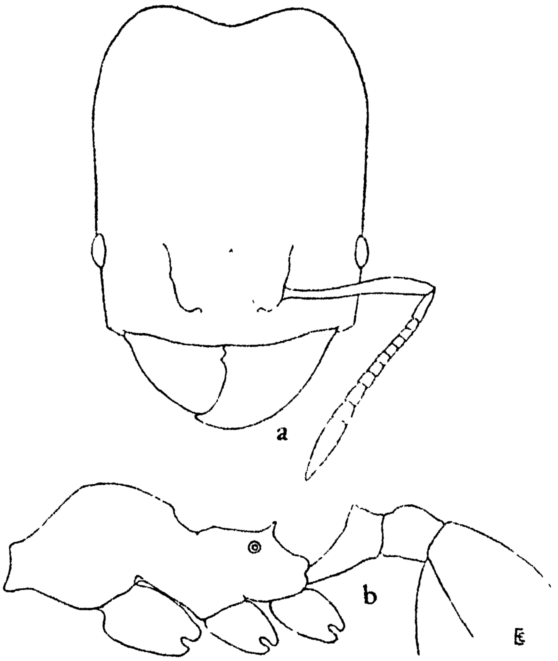


FIG. 12.—PHEIDOLE (ELASMOPHEIDOLE) HONDURENSIS, NEW SPECIES. SOLDIER. *a*, HEAD; *b*, THORAX AND PETIOLE.

broad as head, strongly convex in profile, sides and humeri rounded. Mesoepinotal impression strong. Base and declivity of epinotum rounding into each other, both surfaces flat; spines erect, elongate-triangular, rather bluntly pointed, shorter than their distance apart at base. Petiolar node cuneiform, much shorter than the peduncle, upper border concave at middle. Postpetiole broader than long and nearly twice as broad as petiole: sides subangulate in front of middle. Gaster elongate.

Shining. Mandibles sparsely punctuate. Head with rather fine, elongate, separated longitudinal striae, that extend two-thirds the distance from anterior border to occiput (in antennal fossae finer and more approximate); posterior portion of head and the thorax and abdomen with regular, rather sparse punctures.

Fine, moderately long, erect, yellowish pilosity abundant on head, body and appendages, sparser and semirecumbent on mandibles.

Dark reddish brown, anterior portion of head and the clypeus red, legs brownish yellow.

Worker.—Length 1.5 mm.

Head a little longer than broad and about as broad in front as behind, sides and posterior border nearly straight, occipital angles broadly rounded. Mandibles with eight unequal, separated triangular teeth. Clypeus convex behind, flat in front, broadly rounded at anterior border. Antennal scapes surpassing occipital borders by one-seventh of their length: funicular ioints 2-8, a little longer than broad; basal joint of club distinctly longer than the second, terminal joint about as long as the other two together. Thorax a little more than half as broad as head, evenly convex in profile, with rounded sides and humeri. Base and declivity of epinotum subequal, flat, rounding into each other; spines very small. Petiole and postpetiole as in soldier, but the dorsal surface of the petiole is not excised.

Shining: Antennal fossae with concentric separated striae. Mandibles, head and body sparsely, distinctly puncuate.

Pilosity and color as in soldier.

Type locality.—Honduras: San Juan Pueblo.

Cotypes.—Cat. No. 24450, U.S.N.M.

Described from eight soldiers and three workers.

In the shape of its head, *Ph. hondurensis* approaches *Ph. absurda* Forel. The latter species has the head proportionately longer, the antennae are distinctly shorter and the eyes much smaller, the structure of the petiole and postpetiole and the sculpture is quite different. *Ph. bicornis* Forel, which also has the frontal lobes projecting angulately forward, has a shorter head than *hondurensis*, the clypeus is distinctly concave in front and the head and thorax are subopaque and reticulately rugose.

PHEIDOLE WALKERI, new species.

Soldier.—Length 3.90 mm. (fig. 13).

Head, excluding mandibles, one-fifth longer than broad, slightly narrowed in front, sides nearly straight, occipital corners rounded, occipital border narrowly and rather deeply concave at middle; vertex with a deep median sinus. Blades of mandibles with a pair of very blunt teeth at tips. Clypeus obtusely carinate at middle of basal half, anterior surface rather flat, border very shallowly concave. Frontal lobes short and thick; seen from the side, projecting and broadly triangular; their carinae very short. Antennal scapes slender, extending a little more than half the distance to occipital corners; funicular joints 2–8 a little longer than broad. Eyes small, little convex, situated at anterior third of sides of head. Thorax strongly convex in profile, humeri rounded, sides at middle subgibbous. Mesepinotal impression profound. Base of epinotum distinctly longer than the declivity and separated from it by an angle; surface with a shallowly, longitudinal impression at middle. Spines erect, elongate triangular, shorter than their distance apart at base. Petiolar node in profile blunty conical; dorsal border concave at middle. Postpetiole twice as broad as long, sides at middle somewhat projecting and narrowly rounded. Legs rather stout.

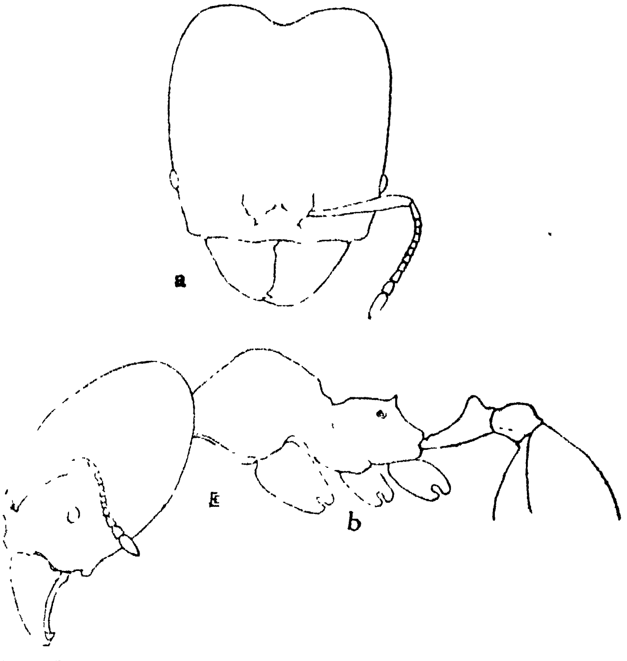


FIG. 13.—PHEIDOLE WALKERI, NEW SPECIES. SOLDIER. *a*, HEAD; *b*, HEAD, THORAX, AND PETIOLE

Shining. Mandibles finely rugulose-striolate and punctate, more densely at base and on outer half, with sparse, rather coarse punctures. Front and vertex rugulose and with fine striae, which are reticulate on the cheeks, longitudinal at middle of front and curving on vertex and occiput and more approximate. Thorax transversely striate. Base of epinotum obliquely striate, feebly at middle, more strongly at sides. Petiolar node transversely striate and posterior surface of postpetiole indistinctly striate. Gaster and legs very finely punctate.

Erect hairs rather coarse, long, moderately abundant on head and thorax, abundant on petiole and gaster, shorter and finer on appendages.

Color black; legs brown.

Worker.—Length 2 mm.

Head slightly longer than broad, a little narrowed in front, sides feebly convex, occipital corners very broadly rounded, posterior border straight. Mandibles elongate, their blades with 7–8 unequal triangular teeth. Clypeus rounded at anterior border. Frontal carinae subparallel, extending to opposite anterior border of eyes. Antennal scapes surpassing occipital corners by about one-fifth their length; funicular joints 2–8 slightly longer than broad; club slender, the first two joints subequal in length and together about as long as the terminal. Thorax in profile moderately convex, sides and humeri rounded. Base of epinotum slightly convex, much longer than the declivity. Epinotal spines triangular, acute, shorter than their distance apart at base, erect. Petiolar node thickly triangular in profile; its posterior border indistinctly excised. Postpetiole less than twice as broad as petiole, longer than broad, sides broadly rounded. Legs rather stout.

Shining. Antennal fossae and cheeks striate and head with a few feeble striae in front. Thorax with sparse and very indistinct transverse striae. Base of epinotum rugulose.

Pilosity and color as in soldier.

Type locality.—Honduras: San Juan Pueblo, Lombardia.

Cotypes.—Cat. No. 24451, U.S.N.M.

Described from numerous soldiers and workers found nesting in rotten wood.

Named in honor of Frederick Walker, soldier of fortune.

PHEIDOLE FIMBRIATA (Roger).

Honduras: Lombardia, Progresso, San Juan Pueblo.

PHEIDOLE PUGNAX Dalla Torre.

Honduras: San Juan Pueblo.

PHEIDOLE GOULDI Forel.

Honduras: Cecilia, Lombardia, Monte Cristo, San Juan Pueblo.

This is the common *Pheidole* of the plantations. It nests in dead wood.

PHEIDOLE ANASTASII Emery, variety CELLARUM Forel.

Honduras: Ceiba.

CREMATOGASTER BREVISPINOSA Mayr, variety.

Honduras: Ceiba, Choloma, San Pedro Sula.

Found at Ceiba in great numbers on trees in a citrus grove, where it makes shelters of casters, though no large nests, and attends the various scale and white-fly parasites of the trees.

CREMATOGASTER ACUTA (Fabricius).

Honduras: Ceiba.

MONOMORIUM CARBONARIUM (Smith), variety EBENINUM Forel.

Honduras: Ceiba.

MEGALOMYRMEX (WHEELERIMYRMEX), new subgenus.

Differing from typical *Megalomyrmex* in the form of the pro- and mesonotum, which are not separated by a suture and together form a hemispherical mass and in the structure of the mandibles, which are flat and with only two teeth.

Genotype.—*Megalomyrmex* (*Wheelerimyrmex*) *silvestrii* (Wheeler).

MEGALOMYRMEX (WHEELERIMYRMEX) SILVESTRII (Wheeler).

A good series of workers were taken at Ceiba and San Juan Pueblo, nesting in the ground or in rotten logs. It is a timid species and very active when disturbed. My specimens agree closely with cotypes from Cordoba, Mexico.

TRANOPELTA COLUMBICA Forel, variety.

Honduras: Lombardia, Tela.

Numerous workers were found under stones in the woods. Emery kindly compared some of my specimens with a cotype of *columbica* in his collection, and writes that the Honduras individuals are paler in color than the typical form.

SOLENOPSIS AZTECA Forel.

Honduras: San Juan Pueblo.

One colony was found. The workers run to this species in Emery's key and agree closely with Forel's description, which was based on specimens from St. Vincent.

SOLENOPSIS PICEA Emery.

Honduras: San Juan Pueblo, Carmelina.

SOLENOPSIS GEMINATA (Fabricius).

In all localities visited.

MACROMISCHA SCANDENS, new species.

Worker.—Length 3.25 mm. (fig. 14).

Head distinctly longer than broad, subquadrate, sides nearly straight, occipital corners broadly rounded, border straight. Mandibles with five stout teeth. Clypeus flat in front and straight at anterior border. Frontal carinae feebly elevated, straight, extending to opposite anterior border of eye. Antennal scapes extending about five-sixths the distance to occipital corners, funicular joints 2–7 transverse; club longer than remainder of funiculus, slender, with the first joint shorter than the second and the terminal longer than the other two together. Eyes large, little convex, situated well in front of middle of sides of head. Thorax robust, convex in profile, pronotum with an indistinct, thick margin at sides, anteroventral corners obtusely angulate. Mesopinotal suture distinct, but not interrupting the sculpture. Base of epinotum flat in profile, as long as the declivity, spines straight, moderately stout, longer than their distance apart at base, directed upward and backward, diverging; inferior spines large, longer than broad, rounded apically. Petiole beneath strongly biconvex in profile, anteroventral tooth elongate triangular, directed forward, peduncle slender, about as long as node and gradually rounding into it; node longer than high, evenly convex in profile, from above longer than broad, with sides rounded. Postpetiole rounded, a little broader than long and broader than the petiole. Legs long and rather slender.

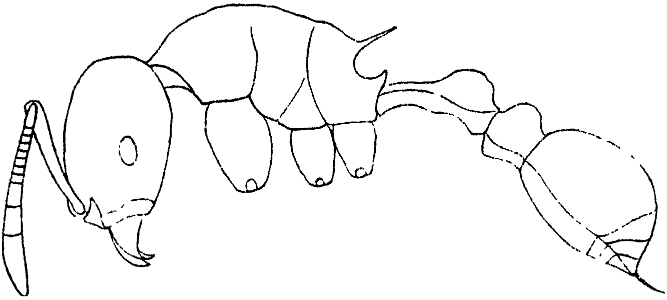


FIG. 14.—MACROMISCHA SCANDENS, NEW SPECIES. WORKER.

Mandibles punctate, shining. Head feebly shining, thorax more shining than the head but much less than the gaster and legs. Head with fine striae, some of them slightly tortuous, longitudinal at middle and becoming diagonal posteriorly at sides, the surface between and the antennal fossae densely punctate. Thorax with coarse, rugae, longitudinal and more regular on the pronotum, tortuous behind. Peduncle of petiole densely, superficially punctate above, node longitudinally rugose. Postpetiole punctate and with indistinct longitudinal rugae. Gaster with very fine and sparse punctation. Legs fairly punctate.

Yellowish, rather stiff erect hairs on head, thorax and abdomen. Appendages with short, fine recumbent hairs.

Dark reddish brown, appendages not or scarcely lighter than the body.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24452, U.S.N.M.

Described from six workers that were found on the trunk of a tree at the edge of the forest. When disturbed they elevated the body and shoved the gaster forward and beneath it in the usual *Macromischa* manner.

In its large size, coarse sculpture, the short antennal scapes and in the structure of the node *scandens* is entirely different from the other Central American species. The *Tetramorium* like habitus is somewhat similar to that of *M. affinus* Mann from Cuba, but the structure of the node is very unlike in the two species. An aberrant form. *M. scandens* might possibly be considered a large *Leptothorax* but has no close relationship with any described species in that genus.

LEPTOTHORAX (GONIOTHORAX) ECHINATINODIS Forel, var. ACULEATINODIS Emery.

Honduras: Ignacio.

One small colony in a twig.

ROGERIA? BELTI, new species.

Worker.—Length 2–2.25 mm.

Head subquadrate, a little longer than broad, sides and posterior border nearly straight. Mandibular blades with six unequal teeth. Clypeus moderately convex, the median portion finely margined, anterior border very feebly concave at middle. Eyes little convex, situated at anterior third of sides of head. Antennal scapes stout, not attaining occipital corners, funicular joints, except the first and the three forming the club, strongly transverse, terminal joint distinctly longer than the two preceding joints. Thorax robust, not very convex above, humeri rounded, inferior angles triangular, not produced. Mesoepinotal suture perceptably impressed, but not interrupting the sculpture. Epinotal base rather flat and sloping, about as long as the declivity; spines straight, acute at tips, as long as their distance apart at base, directed backward and upward and moderately divergent; inferior spines broad and rounded. Petiolar peduncle shorter than the node, which is higher than long and convex in profile and, from above, a little longer than broad, with moderately rounded sides. Postpetiole in profile slightly shorter than the petiolar node and less convex above; from above nearly circular in shape and a little broader than the node.

Shining, the gaster, postpetiole and legs more than the rest. Mandibles shining and finely punctate. Head at middle with longitudinal and at sides with oblique striae, which are somewhat recticulate; occiput and thorax coarsely reticulate, epinotum more widely so. Petiolar node regulose. Postpetiole and gaster finely and sparsely punctate.

Very fine erect hair aboundant on head and body, similar, but shorter, on appendages.

Black. Mandibles and appendages reddish brown.

Type locality.—Honduras: Progresso.

Cotypes.—Cat. No. 24453, U.S.N.M.

Described from a dozen workers from one colony found beneath bark.

Rogeria tonduzi Forel, the only other known Central American species, has the clypeal margins elevated, the thorax is strongly convex and without trace of mesoepinotal impression, the petiolar node rises very gradually from the peduncle and is less elevated than in *belti*, and its eyes are situated more nearly at the middle of the sides of head.

ROGERIA INERMIS, new species.

Worker.—Length, 1.90 mm. (fig. 15).

Head distinctly longer than broad, slightly narrowed in front, sides scarcely convex, posterior corners broadly rounded, border straight. Mandibles with five triangular teeth. Median portion of clypeus elevated and margined at sides by narrow carinae; anterior border broadly concave. Frontal lobes about twice as long as broad, their outer blades broadly rounded. Antennal scapes extending four-fifths the distance to occipital corners; first funicular joint longer than the second and third together, joints 2–8 strongly transverse; club with the terminal joint much longer than the other two together. Eyes composed of about twelve facets, situated at sides of head well in front of middle. Thorax robust, without sutures; inferior angles of pronotum dentiform, anterior corners subangulate, dorsum moderately convex. Basal and declivous parts of epinotum not distinct; border of latter surface unevenly margined, the margin behind ele-

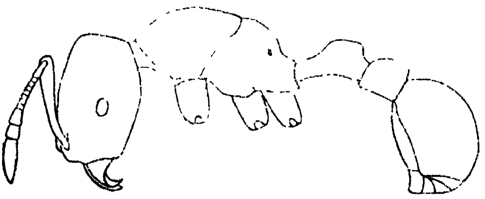


FIG. 15.—ROGERIA INERMIS, NEW SPECIES.

vated into low rounded lamellae. Petiole with a slender peduncle shorter than the node and rounding into it above; node in profile as long as broad, evenly convex above; from above one and one-third times as long as broad. Postpetiole broadest behind, scarcely broader than the petiole and a little longer than broad. Gaster broadly oval.

Gaster shining, body and appendages moderately shining. Mandibles finely punctate and, at base, indistinctly striate. Head irregularly striate, the striae longitudinal on front, slightly oblique at sides and becoming reticulate on occiput, the surfaces between striae uneven and finely punctate. Thorax rugosely striate, two striae at base transverse, the remainder irregularly longitudinal on pro and mesonotum and reticulate on epinotum. Petiole punctate and finely rugulose. Postpetiole finely punctate. Gaster with very fine punctures.

Head and body with moderately abundant, long, erect, silky hairs. Antennae and legs with shorter, fine hairs.

Dark brownish red, gaster black, appendages brownish-yellow.

Type locality.—Honduras: Progresso, Lombardia.

Cotypes.—Cat. No. 24454, U.S.N.M.

Described from five workers. The Lombardia specimen is darker in color and the reticulation of the thoracic rugae is more pronounced.

Rogeria inermis is distinct from the other Neotropical species in having the epinotum unarmed. The shape of the head resembles that of certain species of *Tetramorium* and the petiole, broadest behind, is somewhat similar to some species of *Macromischa.*

APSYCHOMYRMEX MYOPS Wheeler.

Honduras: San Jaun Peublo, Lombardia.

Occurs in small colonies beneath stones, the colonies resembling those of *Rogeria.*

TETRAMORIUH (TETROGMUS) SIMILLIMUM F. Smith.

Honduras: Ceiba.

WASMANNIA AUROPUNCTATA (Roger).

Honduras: Ceiba, San Juan Pueblo. Cecilia, Lombardia.

CRYPTOCERUS GIBBOSUS F. Smith.

Honduras: Ceiba, San Juan Pueblo.

CRYPTOCERUS MULTISPINUS F. Smith.

Honduras: Ceiba, Lombardia.

CRYPTOCERUS ANGULATUS F. Smith.

Honduras: San Juan Pueblo.

CRYPTOCERUS CRISTATUS Emery.

Honduras: Carnelina.

CRYPTOCERUS VARIANS F. Smith.

Honduras: Ceiba.

CRYPTOCERUS MINUTUS (Fabricius).

Honduras: Ceiba, Monte Cristo, Tela.

CRYPTOCERUS MASCULATUS F. Smith.

Honduras: San Juan Pueblo, Choloma.

A colony at Choloma was nesting in Bull's horn Acacia.

ACANTHOGNATHUS LENTUS, new species.

Worker.—Length (including mandibles) 3.50-4 mm. (fig. 16.)

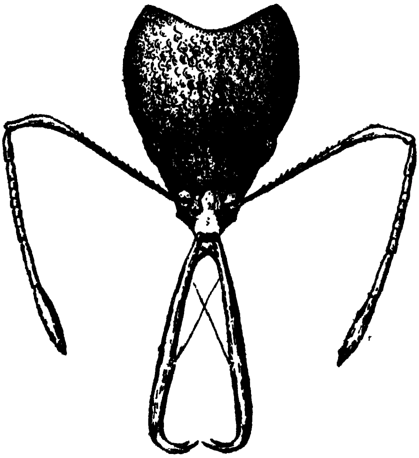


FIG. 16.—ACANTHOGNATHUS LENTUS, NEW SPECIES. HEAD OF WORKER.

Head about one and three-eighths times as long as broad and more than twice as broad at occiput as at anterior border; sides in front of eyes nearly straight, converging, with a small angulate projection at one-third the distance from the anterior margin; sides behind eyes convex: occipital corners narrowly rounded, the border deeply concave. Mandibles as long as head, straight, of subequal width throughout, the apex with three slender teeth the first and third of which are equal and the middle longer; basal inferior spines about one-fifth as long as the mandibles, slightly curved and feebly bidentate at apex. Clypeus narrow behind, extending between frontal lamallae, in front flatly impressed at middle, with the lateral borders slightly elevated and rounded. Antennal foveae large, extending to opposite anterior margin of eye. Antennae slender, scapes very slender for two-thirds their length, then incrassate and narrowed again at tips, slightly surpassing occipital corners; first funicular joint nearly as long as the four succeeding joints together, second joint longer than the third, joints 3-7 gradually increasing in length, joint 8 distinctly longer than the seventh, penultimate joint two-thirds as long and much more slender than the terminal. Eyes moderately large, little convex in profile, armed with pair of stout triangular spines at sides a little in front of middle. Mesoepinotal suture deeply impressed. Base of epinotum about equal in length to the declivity, its surface feebly convex above; spines slender, slightly curved upward, longer than their distance apart at base. Petiole with peduncle slender and much longer than the node; node in profile a little longer than broad, rounded above. Postpetiole barely broader than the petiole and a little longer than broad.

Shining throughout, petiole, postpetiole, gaster and appendages more than the head and thorax. Head with large, shallow, foveolate punctures and feebly reticulated between, thorax coarsely reticulated, base of epinotum reticulated more finely than the thorax, with irregular, transverse, rugae apically. Petiolar peduncle densely punctate and subopaque.

Mandibles with several fine long hairs near tips. Head, thorax, petiole, postpetiole and legs with short, semirecumbent stout hairs, which are most abundant on the head. Gaster with sparse, microscopic pubescence.

Color reddish brown, petiole, postpetiole and gaster black, legs lighter, with the tibiae infuscated, especially apically.

Female.—(deälated) Length 4.10 mm.

Very similar to the worker, with the usual sexual differences.

Type locality.—Honduras: Progresso.

Cotypes.—Cat. 24455, U.S.N.M.

Described from several workers and one deälated female. The colony was nesting in rotten wood. The movements in life are slow, like most of the species of *Strumigenys.*

A. lentus differs from *A. ocellatus* Mayr, the only other known species in its darker color, the more distinct sculpture of the head and thorax and in having the occiput rather narrowly excised. In *ocellatus* the latter is more broadly and roundly excavated.

STRUMIGENYS (STRUMIGENYS) LUDIA, new species.

Worker.—Length, including mandibles, 2.90 mm. (fig. 17).

Head about one-fourth longer than broad, deeply and roundly excavated behind, occipital corners narrowly rounded; sides in front of eyes biconvex, behind eyes feebly convex. Mandibles slightly less than three-fourths as long as head (from occipital corners to anterior border) nearly straight, of subequal width except at base and tip, with three slender apical teeth, the middle of which is one-third as long as the basal and terminal. Clypeus triangular, a little broader than long, shallowly concave at anterior border, the median surface, in front of middle, elevated into a low, rounded tubercle. Supraorbital carinae straight, divergent, two-thirds as long as antennal scapes; scrobes broad and moderately concave. Antennal scapes very slender, extending four-fifths the distance to occipital corners;

first funicular joint as long as the second and third joints together, joints 2–3 longer than broad; penultimate joint two and one-half times as long as the third; terminal joint nearly as long as the remainder of funiculus. Pronotum flat in profile, margined distinctly in front, less distinct at sides; broadest a little in front of middle where the sides are obtusely angulate. Mesonotum submargined at sides. Mesoëpinotal suture shallowly impressed. Base of epinotum narrow, nearly twice as long as the declivity; spines slender, longer than their distance apart at base, moderately divergent, directed backward and upward and slightly curved downward. Petiole in profile gradually rounding into the node, which is little elevated; node from above subquadrate, about as long as broad, with the anterior corners obtusely angulate. Postpetiole broader than long and about one and one-half times as broad as the petiole. Legs long and rather slender.

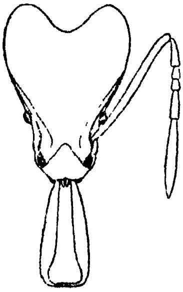


FIG. 17.—STRUMIGENYS (STRUMIGENYS) LUDIA, NEW SPECIES. HEAD OF WORKER.

Subopaque, coarsely and granulosely punctate, more finely on gaster; the posterior portion of head, the pronotum and the base of gaster with longitudinal striae, straight on the gaster and irregular on the pronotum and head.

Hairs short and curved on head, thorax and appendages, club-shaped on supraocular border, straight and elongate-claviform on gaster. Spongiferous hairs well developed on posterior margins of petiole and postpetiole and ventral surface of the latter.

Brownish yellow.

Type locality.—Honduras: Cecilia.

Cotypes.—Cat. No. 24456, U.S.N.M.

Described from a series of workers from a colony that was nesting in a small pocket in a rotten log.

Near *elongata* Roger but larger, with longer mandibles, less abrupt petiolar node and entirely different sculpture. The antennal scapes are much more slender than in the related *imitator* Mayr from Brazil which differs also in having the gaster smooth, except for the short basal striae, and shining.

STRUMIGENYS ELONGATA Roger.

Honduras: Ceiba, San Juan Pueblo, Cecilia, Progresso, Choloma.

Small colonies were found in rotten wood. The workers have the thorax densely punctate, and the pronotum is longitudinally carinate at middle.

STRUMIGENYS BIOLLEYI Forel.

Honduras: Lombardia.

One large colony in a rotten log. The workers resemble those of *Acanthognathus lentus* in general appearance.

STRUMIGENYS (STRUMIGENYS) EMERYI, new species.

Worker.—Length, including mandibles, 2.10 mm. (fig. 18).

Head about one-fourth longer than broad, posterior border convexly excised, occipital corners evenly rounded; sides posterior of eyes nearly straight, in front of eyes feebly convex. Mandibles straight, rather thick, more than half as long as head, with two long terminal spines which have a shorter spine between them and one subapical spine, situated near the basal apical and about one-third its length. Clypeus nearly as long as broad, narrowed behind, truncate at anterior border. Frontal carinae straight, divergent, bordering scrobes, three-fourths as long as the head and containing the entire antennal scapes. Antennal scapes extending about three-fourths the distance to occipital corners; funiculus not very slender, first joint longer than the second and third together, second and third joints about as broad as long. Eye slightly convex. Pronotum nearly flat, humeri obtusely angulate. Mesoëpinotal suture rather strongly impressed. Epinotal base flat, longer than the declivity, spines shorter than their distance apart at base, acute at tips, lamellate beneath, the lamellae continuing as margins to the declivity. Petiolar peduncle slender, as long as the subglobose node which rises abruptly from it. Postpetiole oval, transverse, one-half broader than the petiole. Legs slender.

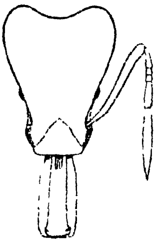


FIG. 18.—STRUMIGENYS (STRUMIGENYS) EMERYI. HEAD OF WORKER.

Gaster and dorsum of postpetiole strongly shining and smooth except for short costae at base of gaster; head, thorax, and appendages moderately shining. Mandibles densely punctate. Head rugosely punctate and with coarse, fine striae, longitudinal on front and becoming reticulate behind. Thorax finely punctate and more shining than head, with a median carina which is strong on the pronotum, weaker on the mesonotum; and irregular, longitudinal carinulae. Epinotal base shallowly punctate. Petiolar node rather coarsely punctate.

Sparse very long and flexnous hairs, mingled with shorter curved hairs on thorax and abdomen and elongate, curved, clavate hairs on head and antennal scapes. Spongiferous masses on posterior borders and ventral surfaces of nodes.

Reddish brown; gaster darker than the rest.

Female.—(deälated). Length 2.50 mm.

Ocelli small. Mandibles shorter than in worker. Epinotal spines thicker.

Sculpture similar to that of worker, but rather coarser; median carina of pronotum interrupted by impression between pronotum and scutellum but extending length of scutellum.

Type-locality.—**Honduras: Ceiba, San Juan Pueblo.**

Cotypes.—Cat. No. 24457, U.S.N.M.

Several small colonies were found in rotten logs.

This species approaches *S. fusca* Emery but is much smaller, the head is more narrowed in front and the occipital incision narrower; the clypeus is much longer. The straight mandibles are longer than in *louisianiae* Roger and its varieties, from which *emeryi* differs also in lacking the very short, squamiform hairs on the head.

STRUMIGENYS CORDOVENSIS Mayr.

Honduras: Ceiba.

One large colony of this beautiful species was found nesting in rotten wood.

STRUMIGENYS BREVICORNIS, new species.

Worker.—Length 1.50 mm.

Head elongate, narrowly concave at middle of posterior border; sides convex posterior to eyes, very slightly convex and subparallel in front of eyes. Mandibles less than half as long as head, rather slender and tapering, outer border shallowly concave in front of middle, inner border edentate basally, a small though distinct tooth in front of middle and several very fine, separated denticulae between this and the tips. Clypeus slightly broader than long, rounded at anterior border. Antennal scapes less than half as long as head, the upper border very shallowly concave, the inner border roundly expanded at middle; first funicular joint as long as the second and third together, third joint a little shorter than the first; terminal joint slightly longer than the remainder of funiculus. Pronotum nearly flat, margined in front, humeri rounded. Epinotal spines triangular, their width at base nearly as great as their length and their length a little shorter than their distance apart at base. Petiolar node from above broader than long, very slightly broader behind than in front, with feebly convex sides and nearly straight anterior border; in profile a little shorter than the pedicel, rounded above and sloping in front. Postpetiole about twice as broad as petiole, excised at middle of posterior half.

Head, thorax, petiole and postpetiole coarsely cribrate-punctate and nearly opaque. Gaster shining and smooth except for short basal striae. Erect hairs elongate-clavate, sparse on head, thorax and abdomen; curved, flattened hairs on clypeal margin, border of antennal scapes and tibiae and tarsi. Ventral and posterior margins of postpetiole with moderately well-developed spongiform hairs.

Pale reddish brown, gaster, except base, dark brown to black.

Female (deälated). Length 1.90 mm.

Epinotal spines broader, petiole node less elevated and sloping more gradually in front and color darker than in the worker.

Type locality.—Honduras: Ceiba.

Cotypes.—Cat. No. 24458, U.S.N.M.

Described from one female and five workers.

This species is related to *S. crassicornis* Mayr from Southern Brazil, which differs in its longer epinotal spines, longitudinally ridged pronotum, more angulately expanded antennal scapes and in lacking (at least in the specimen before Mayr) the spongiform brush on the postpetiole.

STRUMIGENYS ALBERTI Forel.

Honduras: San Juan Pueblo, Cecilia.

The first gastric segment of the workers in my series is more strongly infuscated than in workers from Hayti and Cuba and one from Costa Rica (collection Forel) but the specimens seem otherwise the same.

RHOPALOTHRIX (RHOPALOTHRIX) AMOENA, new species.

Worker.—Length 1.75 mm.

Head, excluding the mandibles, a little longer than broad, shallowly and broadly concave behind, posterior portions of sides convex instead of straightly truncate as usual in the other species, anterior portion of sides nearly straight and subparallel. Clypeus flat, distinctly broader than long, anterior border nearly straight. Mandibles slender, the outer border feebly concave at middle, tips slender, blades with eight triangular teeth. Antennae 7-jointed, scapes at base about one-fourth as broad as long, the basal corner rounded, first funicular joint slightly broader than long and much broader than the second, joints 2–5 transverse, the third and fourth more strongly than the second and fifth; terminal joint nearly as long as the remainder of funicular. Eyes convex. Pro-mesothorax a little longer than broad, widest and rather narrowly rounded at middle, surface feebly convex. Mesoepinotal suture distinct. Base of epinotum as long as the declivity, slightly convex in front, flat behind. Epinotal spines strongly compressed, triangular, very feebly curved at tips, their bases extending as lamellate margins to the declivity. Petiolar peduncle about as long as wide, which is flat above, barely broader than long, with sides and corners rounded and anterior border straight. Postpetiole twice as broad as long and more than twice as broad as petiole, its surface narrowly excised in back of middle.

Nearly opaque. Head and body coarsely cribately punctate, the head somewhat rugulose, especially in front. Mandibles and legs densely punctate and not more shining than the rest.

Head and body (except epinotum) and appendages with elongate, flattened-subappressed, whitish hairs. Head, thorax, and gaster beset with regular, very coarse, club-shaped hairs.

Ferruginous red, with legs paler.

Female.—(deälated). Length 1.90 mm.

Petiolar node concave at middle of front, with the anterior corners more prominent than in the worker, otherwise similar, excepting the usual sexual differences.

Type locality.—Honduras: Ceiba, Cecilia.

Type.—Cat. No. 24459, U.S.N.M.

Described from a single female and a small series of workers from two colonies taken by breaking apart red-rotten wood.

This species is related to the South American *R. ciliata* Mayr and *R. bolaui* Mayr, the latter known only from a female, both of which are much larger in size.

RHOPALOTHRIX (RHOPALOTHRIX) GRAVIS, new species.

Worker.—Length 2.30-2.50 mm. (fig. 19).

Head, excluding mandibles, slightly longer than broad, broadly and rather strongly concave behind, posterior portion of sides obliquely truncate. Clypeus about twice as broad as long, nearly straight at anterior margin. Mandibles rather stout, outer border very feebly concave at middle, blades with ten teeth. Antennae 7-jointed, their scapes at base a little more than one-fourth as broad as long, the outer angle narrowly rounded; first funicular joint longer than broad, second joint as long as broad, joints 3–4 slightly longer than broad, terminal joint as long as remainder of funiculus less the first joint. Eyes small, strongly convex. Thorax with a very indistinct impression, which does not interrupt the sculpture, in the region of the promesonotal suture and constricted at sides. Sides of pronotum subgibbous. Mesonotum convex in outline. Mesoepinotal suture strongly impressed. Base and declivity of epinotum subequal in length, the surface of the former nearly flat in front and concave between the spines which are half as long as the declivity, broadly triangular in shape, much compressed, directed backward and slightly upward, at base extending as narrow margins to sides of

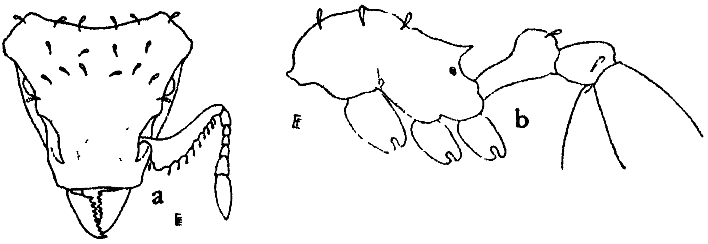


FIG. 19.—RHOPALOTHRIX (RHOPALOTHRIX) GRAVIS, NEW SPECIES WORKER. *a*, HEAD; *b*, THORAX AND PETIOLE. (ONLY THE LARGER HAIRS ARE SHOWN.)

epinotal declivity. Peduncle of petiole a little longer than the node; node in profile slightly higher than long, abrupt in front and behind and nearly flat above; from above, as long as broad, feebly convex at sides and straight at front and posterior borders. Postpetiole much broader than petiole and more than twice as broad as long, longitudinally concave at middle.

Opaque. Head and thorax punctate and rugulose, epinotum transversely seriolate; petiole, postpetiole and gaster cribately punctate. Mandibles, legs, and antennal scapes densely punctate.

Subappressed squamiform hairs moderately abundant on head, body, and appendages, sparse on epinotum; longer, clavate hairs on outer border of antennal scapes and the apical portions of legs; coarser, clavate hairs regularly arranged on head, thorax, and abdomen.

Brownish red; legs paler.

Female.—Length, 2.90 mm.

Thorax and scutellum rugulose, the former more strongly than in the worker. Epinotal spines a little shorter than in workers. Wings strongly infuscated.

Male.—Length, 2.80 mm.

Head, excluding mandibles, longer than broad, shallowly and broadly excised behind, posterior portion of sides truncate. Clypeus broad, rounded at sides posterior to middle, very feebly concave at anterior border. Mandibles well developed, acute at tips, their blades strongly concave. Eyes elongate oval, convex, slightly shorter than their distance to occipital corners. Ocelli large. Frontal lobes prominent, truncate apically. Antennae 13-jointed, first joint twice as broad at base as at apex, twice as broad and slightly longer than the second joint, which is about half as long as the third, joints 3–12 elongate, subcylindrical, terminal joint longer than the penultimate, but shorter than the two preceding joints together. Mesothorax shallowly, longitudinally impressed at middle, shallowly concave behind. Scutellum about as long as broad, little convex, impressed at middle of posterior border. Base and declivity of epinotum equal in length; spines bluntly triangular, a little longer than broad at base, declivity narrowly margined at sides. Petiole elongate, the node rounded above; from above, a little broader than long, rounded at sides and straight in front; anteroventral spine long and pointed, directed forward. Postpetiole transverse and twice as broad as petiole. Gaster rather strongly narrowed behind. External valves of genitalia long and slender, narrowly rounded apically. Legs long and very slender.

Gaster shining, pleurae, in part, and petiolar node feebly shining, the rest opaque. Head and thorax densely punctate and rugulose.

Petiole densely and postpetiole more shallowly punctate. Legs finely and densely punctate. Gaster smooth.

Hairs fine, long and black on head and body, shorter and semirecumbent on legs.

Black, legs fulvous, wings strongly infuscated.

Type locality.—Honduras: Lombardia; San Juan Pueblo.

Cotypes.—Cat. No. 24460, U.S.N.M.

RHOPALOTHRIX (OCTOSTRUMA) BARBERI, new species.

Worker.—Length, 1.75 mm.

Head, excluding mandibles, barely broader than long, half as broad at clypeus as at occiput, posterior portion of sides not distinctly truncated, occipital corners rounded, occipital border shallowly concave at middle. Mandibular blades with four elongate, triangular teeth, tips acute. Clypeus as broad as long, truncate in front, posterior border narrowly rounded. Antennal scapes extending less than two-thirds the distance to occipital corners, their width at base equal to three-eighths their length, expanded and narrowly rounded at base; first funicular joint one and one-third times as long as broad; joints 2-5 strongly transverse, joint six less transverse; terminal joint nearly as long as the remainder of funiculus. Eyes small and feebly convex. Pro-mesonotum rather flat in profile; from above, evenly rounded at sides. Mesoëpinotal impression very distinct. Base of epinotum flat, sides straight, spines much shorter than their distance apart at base, compressed, triangular. Petiolar node shorter than the pedicel, from which it rises abruptly, higher than long and higher in front than behind; from above, broader than long, with straight anterior and posterior borders and feebly convex sides. Postpetiole about one and one-half times as broad as petiole.

Opaque, densely cribrately punctate, more rugosely on head.

Claviform hairs sparse on head, thorax, and petiole and tibiae, more abundant on gaster, a row along border of antennal scapes. Short, fine recumbent hairs rather sparse on head, body, and appendages.

Dark reddish brown.

Type locality.—Guatemala: Cacao, Trece Aguas, Alta V. Paz (Barber and Schwarz).

Cotypes.—Cat. No. 24461 U.S.N.M.

This species belongs in the group with *balzani* Emery and *batesi* Emery. It is distinct from the first of these in its more elongate antennal scapes, from the second in its much smaller size and from both in having the sides of head behind the eyes less truncated and in the occipital border being narrowly, though very distinctly, concave at middle.

RHOPALOTHRIX (OCTOSTRUMA) WHEELERI, new species.

Worker.—Length 2.20 mm.

Head slightly broader than long, sides posterior to eyes truncated, posterior border nearly straight. Mandibles slender, especially at apical half, outer border concave at middle, blades with five strong, elongate triangular teeth. Anterior border of clypeus broadly rounded. Antennal scapes but moderately dilated at base, with the angle broadly rounded; funicular joints 2-5 less than twice as broad as long, joint six longer than broad, terminal joint about as long as remainder of funiculus. Eyes small, little convex. Thorax very feebly arcuate in profile from front to epinotal base; from above rounded at middle of sides in the pronotal portion, sides nearly straight behind. Mesoëpinotal impression entirely obsolete. Epinotal base sloping, on a different plane from the mesonotum and separated from it by a rounded angle, flat, longer than broad and barely longer than the declivity: the two surfaces separated by a transverse carina. Spines broadly triangular, their width at base greater than their length, shorter than their distance apart at base. Petiolar node nearly one and one-half times as broad as long, suboval; in profile higher than long and as long as peduncle, abrupt in front, dorsum feebly convex and sloping from front to rear. Postpetiole about two times as broad as long and one and one-half times as broad as the petiole.

Head and thorax moderately shining, petiole and gaster nearly opaque. Mandibles, antennae and legs finely and densely punctate. Head rugose, fovoelately punctate and with fine striae, some of them reticulate; occipital region more finely punctate. Pro-mesonotum fovolately punctate in front and sides, the median portion and the epinotum and sides exceedingly finely and densely punctate (with an almost velvety appearance). Petiole and postpetiole rugose and coarsely punctate. Gaster cribrately punctate.

Head and body thinly covered with fine, short, silky hairs; front of head with very spart elongated clavate hairs. Hairs on border of antennal scapes stiff, but not clavate. Legs with short and stiff, suberect hairs, some on tibiae clavate.

Fuscous; legs somewhat lighter than the rest.

Type locality.—Guatemala: Livingstone (Barber and Schwarz).

Type.—Cat. No. 24462, U.S.N.M.

Described from one worker.

This is a peculiar species resembling *Rh. petiolata* Mayr in the absence of the mesoëpinotal impression. The latter species has the antennal scapes strongly dilated at base and the petiolar node is twice as broad as long and the body is opaque.

CYPHOMYRMEX COSTATUS, new species.

Worker.—Length 1.50 mm.

Head longer than broad, narrowest in front, broadly concave behind, occipital corners subangulate; occiput at middle with a pair of low rounded, longitudinal ridges, parallel to each other and becoming obselete on the vertex. Clypeus much longer than broad, triangular, nearly flat in front, with the anterior border very faintly concave at middle. Mandibles acute apically, the blades with five short teeth. Frontal lobes nearly flat, each distinctly longer than broad, with the outer border broadly and evenly rounded; continuous with the carinae, which extend straight and divergent to the occipital border. Antennal scrobes broad and deep, bordered beneath by a low, rather thick ridge which is interrupted at middle by the eye. Antennal scapes short, not attaining occipital corners, very slender at basal third, apical portion strongly incrassate; median funicular joints about twice as broad as long; terminal joint long and strongly narrowed at tip. Pronotum feebly convex, sides with a pair of rounded tubercles in back of middle; humeri obtusely angulate; inferior angles blunt, not spinose. Pro-mesonotal suture not impressed. Mesonotum concave, sides with a rather thick margin, which is shallowly impressed a little posterior to the middle. Base of epinotum about as long as the declivity, a little longer than broad, concave at middle, margined at sides, the margins angulate. Petiole shorter and much thinner than the postpetiole, the dorsal surface sloping and highest posteriorly; from above, nearly two times as broad as long, widest in front. Postpetiole one and one-half times as broad as the petiole, a little broader than long, with two coarse, rounded longitudinal ridges which are a little higher and thicker behind than in front. First gastric segment with four strong and even longitudinal ridges for its entire length, the surface between these slightly convex. Legs short, the flexor surfaces of the posterior and middle femora strongly expanded a little basal to middle; tibiae short and very stout, the anterior pair much shorter than the tarsi, in cross section with the sides meeting at angles.

Subopaque. Finely and densely punctate throughout, with short, recumbent, white hairs moderately abundant on head, gaster and appendages and sparse on thorax.

Yellowish brown, the posterior part of head darker than the rest.

Type-locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24463 U.S.N.M.

Described from three workers found in rotten wood.

This, though evidently a true *Cyphomyrmex*, is curious in its very short, stubby legs and the very strong carinae on the gaster. The antennal scapes are shorter and much thicker than usual in the genus. *C. strigatus* Mayr from Brazil has a similarly sculptured gaster, but is larger and the thorax bears prominent tubercles at sides and one at the middle of pronotum and lacks the longitudinal margins of *costatus.*

CYPHOMYRMEX RIMOSUS (Spinola), variety MINUTUS Mayr.

Honduras: Ceiba, Lombardia, San Juan Pueblo, San Pedro Sula, Tela.

MYRMICOCRYPTA CUCUMIS, new species.

Worker.—Length 2.50 mm.

Head, excluding mandibles, slightly longer than broad, sides feebly convex, posterior corners rounded, border concave. Mandibles 8-dentate. Clypeus little convex, nearly straight at anterior border. Frontal lobes thin, their outer borders rounded. Frontal carinae feeble, nearly straight, divergent, extending nearly to occipital border. Cheeks with a sharply defined, straight carina extending inwardly to the eyes, from near base of mandibles a little less than half the distance to occipital borders. Antennal scapes surpassing occipital corners by a distance a little greater than their diameter at tips; first funicular joint one and one-half times as broad as the second and as long as the second and third together, joints 2–8 slightly longer than broad, penultimate joint less than half as long as the terminal. Eyes moderate in size and convex, situated in front of middle of sides of head. Thorax stout, the sutural impression broad and shallowly concave and not interrupting the sculpture. Pronotum flat and sloping in front, the posterior portion a very transverse area, convex at middle and nearly flat at sides, separated from the front by a row of short spines; humeri angulate and shortly spinose; inferior angles with a short, blunt, downward-pointing spine. Mesothorax nearly flat in front and slightly sloping from front to rear, behind more strongly sloping. Epinotum anteriorly with a slightly convex surface that is twice as broad as long; the posterior portion in the same plane as the declevity, thinly margined at sides; at middle with an elongate, bluntly pointed spine that points upward and backward. Petiole short, not pedunculate, in profile but slightly longer than high and thinner behind than in front; from above as long as broad. Postpetiole twice as broad, twice as thick and two and one-half times as long as the petiole; in profile longer than broad, highest in front, with a feebly convex anterior surface which broadly rounds into a long, flat posterior surface; from above, a little longer than broad, broadest at middle, anterior border narowly rounded, sides feebly convex. Gaster in profile thick, the sides obsoletely margined; from above the sides of the first segment are nearly parallel. Legs long and rather slender.

Mandibles sublucid, rather strongly striate and with a few stiff hairs. Head and body densely granulosely punctate and in addition beset with short, thick spines, which are truncated at tips and bear each a strongly curved, elongate, flattened hair. These spines are regularly arranged, sparsely and mostly on the margin of the thorax, though there is a transverse row on the pronotum and three pairs inward from the marginal row on the mesonotum.

Appendages densely punctate and with suberect, rather stiff hairs.

Color reddish brown.

Female.—(deälated). Length 3.10 mm.

Head similar to that of worker, but with longitudinal rugae on front. Pronotum with short and stout humeral spines. Mesothorax nearly as broad as long, its surface flat. Scutellum a little broader than long, strongly excised posterior border, with nearly straight, convergent sides that terminate in stout spines and project laterally. Epinotal base and declevity not distinct from each other, with short, very broad lateral spines. Petiole and postpetiole similar to those of worker.

Granulose, punctate and opaque, mesothorax and scutellum with short, longitudinal rugae. Spines somewhat shorter than in the worker; lacking on the thoracic dorsum.

Curved hairs moderately abundant on head, thorax and appendages.

Color as in worker.

Type locality.—Honduras: Progresso.

Type.—Cat. No. 24464, U.S.N.M.

MYRMICOCRYPTA EDNAELLA, new species.

Worker.—Length 2-2.25 mm. (fig. 20).

Head one-fourth longer than broad, slightly narrowed in front, sides little convex, occipital corners subangulate, border nearly straight; vertex rather strongly impressed at middle between the frontal carinae, occiput with three smaller impressions, the outer two of which are bordered by fine carinae. Mandibles long and pointed, 6-dentate. Clypeus broadly rounded at anterior border, median portion elevated and margined at sides. Frontal lobes short and rather thick, carinae parallel to nearly opposite anterior border of eyes, then arcuate and bordering vertical impression and extending on occiput. Eyes small, convex, situated at middle of sides of head. Postorbital carinae fine but distinct, extending to occipital corners. Antennal scapes rather stout, slightly surpassing occipital corners; first funicular joint a little shorter than joints 2–3 together, second joint barely broader than long, joints 3–8 a little longer than broad, terminal joints shorter than the three joints preceding. Pronotum nearly flat in front, more concave behind, divided by a very obtuse angle into two surfaces, the anterior of which has at sides thick margins that terminate as broadly triangular spines, and the posterior by more approximate, finer carinae, which are dentate bluntly in front and extend in a concave curve on the sides of the mesothorax where they are bidentate; humeral spines short and blunt. Mesoëpinotal impression strong, bordered by a continuation of the pro-mesothoracic carina. Base of epinotum flat, quadrate, much longer than broad, shorter than the declivity, both surfaces with thin lateral margins which bear triangular spines at the angle. Petiolar peduncle longer than the node, anteroventral spine very small, node in profile rounded in front, flat and sloping above; from above, longer than broad, rounded in front and concave at posterior border. Postpetiole more than twice as broad and a little longer than the petiolar node, broadest behind. Gaster rather flat above, especially basally: margined at sides.

Densely granulose-punctate and opaque. Mandibles punctate and striolate and subopaque.

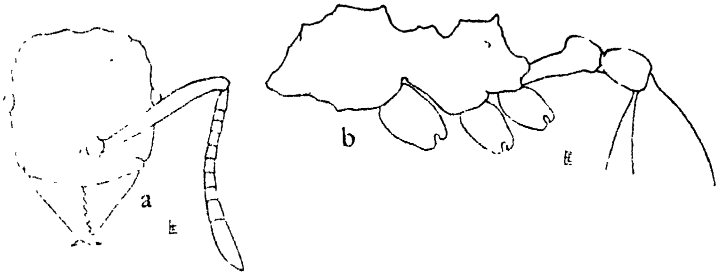


FIG. 20.—MYRMECOCRYPTA EDNAELLA, NEW SPECIES. WORKER a, HEAD; b, THORAX AND PETIOLE

Hairs on head and body short and clavate, moderately abundant and regularly arranged on head, postpetiole, and gaster, sparse and only on ridges of the thorax, epinotum, and petiole, with half a dozen on anterior portion of pronotum. Appendages with abundant strongly-curved semirecumbent squamiform hairs.

Yellowish brown to dark reddish brown. Pilosity white.

Female.—(deälated). Length 3.10 mm.

Head resembling that of the worker; ocelli small. Pronotum with broadly triangular, horizotal humeral spines and much larger and thicker spines at middle of side margin. Mesonotum irregularly margined at sides and with a pair of parallel ridges on median surface. Scutellum broader than long, carinate at middle, the surface on either side depressed and flattened, posterior margin projecting horizontally as strong, blunt teeth, sides margined, the margins on front elevated as large, broad spines rounded at tips. Epinotal spines stronger than in worker.

Sculpture similar to the worker except that the occipital region of the head and the thorax bear irregular striae.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24465, U.S.N.M.

Described from two females and a small series of workers taken from colonies beneath stones. The fungus gardens are pendulous, hanging from the underside of the stones into little pockets, which evidently are excavated by the ants. They are small in size—a little smaller and somewhat the same shape as a thimble. There are few individuals in a colony.

The three impressions on the occiput, margined by the ridges, which give the border superficially the appearance of being biconcave, and the form of the frontal carinae are very characteristic.

MYCOCEPURNS SMITHI Forel, variety TOLTECA Wheeler.

Honduras: Ceiba.

SERICOMYRMEX OPULENTA, new species.

Worker.—Length 4 mm. (fig. 21).

Head, excluding mandibles, slightly longer than broad, broadest at middle of sides: occipital corners projecting as strong, triangular, rather bluntly pointed spines, from the bases of which thick ridges extend to the frontal lobes. Occipital groove strong, extending down vertex to opposite the frontal lobes and bordered basally by ridges which half way down curve outwardly and join those which extend from the occipital spines. Sides nearly straight, behind terminating as short, blunt spines. Mandibles elongate, their blades with eight short teeth, outer border distinctly concave at middle. Frontal lobes large, widely separated, elevated, and thickened laterally; the surface between their posterior halves elevated and with two short, poorly defined ridges. Eyes large. Antennal scrobes strong, bordered outwardly by their carinae, which extend from in front of the eyes four-fifths the distance to occipital border, and inwardly by the thick

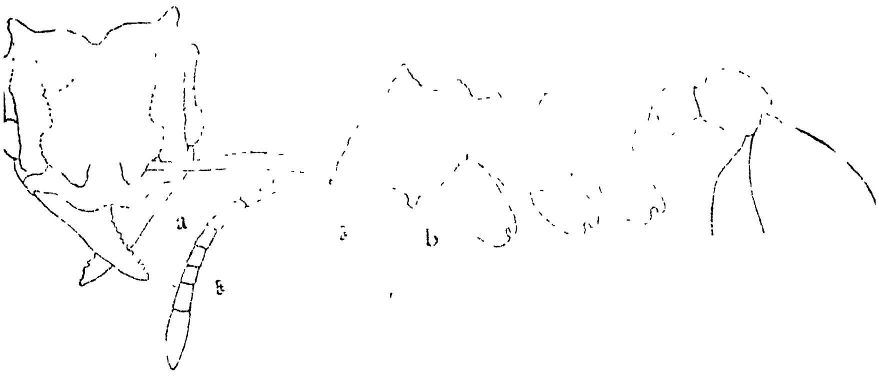


FIG. 21.—SERICOMYRMEX OPULENTA, NEW SPECIES. WORKER. *a*, HEAD; *b*, THORAX AND PETIOLE.

ridges from the bases of occipital spines to the frontal lobes. Antennal scapes extending a little beyond the tips of occipital spines; funiculus slender, gradually and feebly thickened apically, first joint slightly shorter than the second and third together, all joints much longer than broad and increasing in length toward the tips, terminal joint slender, longer than the two preceding joints together. Pronotum broader than long, narrowed in front, surface sloping in front, sides with a pair of blunt tubercles near posterior margin, inferior angles with elongate, bluntly pointed spines. Mesothorax with three pair of thick spines, the first more than twice as long and much stouter than the intermediate pair, which are twice as large as the posterior pair. Mesoepinotal suture strongly and broadly impressed. Base of epinotum about as long as the declivity, bordered by a pair of low, irregularly denticulate ridges, which terminate as short, compressed, bluntly pointed spines; declivity broad and nearly flat. Petiole in profile longer than high, convex above, sides with a short longitudinal ridge; from above longer than broad, very slightly broader in front than behind, with a pair of narrow, lateral ridges at posterior half. Postpetiole nearly twice as broad as petiole, broader than long, broadest behind, strongly and broadly longitudinally grooved above. Gaster with a series of four longitudinal ridges. Legs long and slender.

Opaque. Mandibles feebly shining, densely striate basally. Head and body densely punctate and unevenly rugose. Appendages densely punctate.

Body and appendages with abundant long, fine hairs which are black basally and white toward the tips. These are stiffer, less erect, and curved on the appendages. Appendages also with recumbent, very fine and silky golden pilosity.

Reddish brown to dark reddish brown.

Type locality.—Honduras: San Juan Pueblo.

Type.—Cat. No. 24466, U.S.N.M.

Described from a series of workers taken in a large colony. The nest was in the ground, alongside a trail in thick woods. The entrance was in the form of a turret, loosely constructed of earth and about 6 inches in height; a foot beneath the surface was a large cavity, containing a fungus garden, pendulous and 4 or 5 inches in diameter.

The arrangement of the tubercles is somewhat similar to that in *S. sausaueri* Emery, which species, however, has but two pair on the mesonotum and also has shorter epinotal spines, but otherwise *S. opulenta* is very different from the other described species of *Sericomyrmex*.

APTEROSTIGMA ABDITA, new species.

Worker.—Length, 3 mm. (fig. 22).

Head, excluding mandibles, nearly one and one-half times as long as broad, with nearly straight, subparallel sides, and broadly rounded occipital corners; posterior portion suddenly contracted into a short neck which has a distinctly reflected border. Front with a rather strong impression, bordered by the frontal carinae. Clypeus much broader than long, anterior border feebly rounded. Frontal lobes large and thick, with a strong impression between. Mandibles with a series of twelve teeth, the apical two largest. Antennae stout, their scapes surpassing the occipital corners by about one-fourth their length; first funicular joint a little longer than the second and third joints together; joints 2–10 very slightly broader than long; penultimate joint distinctly broader than long; terminal joint about as long as the four joints preceding. Eyes convex, situated posterior to middle of sides. Pro-mesothorax strongly convex in profile; anterior border elevated into a low, thick ridge. Mesonotum with a pair of rather indistinct, thick, longitudinal ridges. Base of epinotum feebly convex, longer than the flat declivity and broadly rounding into it. Epinotal stigmata prominent. Petiole from above more than twice as long as broad, widest behind and gradually narrowing to the stigmata; posterior third with a pair of short and blunt ridges; in profile the node is low and rounded, with rather abrupt, nearly straight posterior slope. Postpetiole a little broader than long, broadest behind, the slightly convex sides gradually converging anteriorly; posterior border very feebly excised and the dorsum indistinctly impressed. Gaster short and elliptical, the first segment margined at sides by an obtuse ridge.

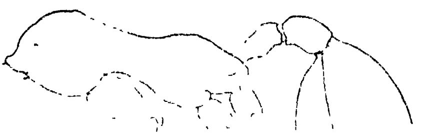


FIG. 22.—APTEROSTIGMA ABDITA. THORAX AND PETIOLE OF WORKER.

Mandibles very finely and densely striate and shining; antennal funiculi feebly shining; head and body opaque, finely and densely, somewhat granulosely punctate; legs punctate similar to body.

Pilosity abundant, on the head and body long and flexuous, on the legs and scapes shorter, curved and subappressed. On the legs and scapes there are also some longer hairs, similar to those on the body.

Color brown.

Female.—(deälated). Length 4 mm.

Pro-mesonotum strongly convex in profile. Scutellum rather flat; posterior border concave at middle, with broad, obtuse teeth laterally. Epinotal base and declivity not distinct from each other, margined at sides, the margin obtusely angulate at middle. The rest as in worker, with the usual sexual differences.

Type-locality.—Honduras: San Pedro Sula, San Juan Pueblo.

Cotypes.—Cat. No. 24467, U.S.N.M.

Described from a large series of workers and one female, collected from nests in rotten wood.

This species is near *mayri*, differing from it in the more slender petiole and in having the hairs on the scape curved at the tips toward the surface, instead of being straight and obliquely divergent.

APTEROSTIGMA COLLARE Emery.

Honduras: Lombardia, San Juan Pueblo, Choloma, Tela, San Pedro Sula.

An abundant species occurring in moderate-sized colonies in rotten wood.

ATTA CEPHALOTES (Linnaeus).

Honduras: Generally distributed and abundant.

I saw comparatively little damage done to citrus by this ant in Honduras. In several native plantations files of workers were busy cutting the leaves, but no trees had been completely defoliated. The one large commercial plantation (at Ceiba) seemed to be free from the ants. Other plants were badly attacked, and I saw one patch of young cocoa trees entirely stripped of leaves. The Hondurian name for this species is "wee-wee."

Subfamily DOLICHODERINAE.

DOLICHODERUS (HYPOCLINEA) LUTOSUS F. Smith.

Honduras: Choloma, Lombardia.

At Choloma this species was nesting in the hollowed parts of pine trees.

There is a great deal of variation in color among the workers, more especially in the amount of infuscation on the gaster, but in all specimens the apical borders are distinctly darker than the remainder.

ACTECA INSTABILIS F. Smith.

Honduras: Cecilia, San Juan Pueblo, Progresso.

AZTECA INSTABILIS F. Smith, variety MEXICANA Emery.

Honduras: Choloma.

One colony found in a hollow stump of a pine tree.

AZTECA ALFAROI Emery.

Honduras: Choloma, Ignacio.

This is the species most common in a local Cecropia (the "Guaruma," of the Hondurianians), where it occurs in large colonies. In one instance I collected from one Cecropia seven deälated females of *alfaroi*, each in a separate cavity, and one of them with an incipient colony.

Coccidae live in the cavities and are tended by the ants, as first recorded by Belt in his "Naturalist in Nicaragua." There were also, in Honduras, dipterous pupae, probably Phoridae, in with the ants. Those which I found had been parasitized by a small undetermined Hymenopterous pupæ of which were found in the fly puparia.

Subfamily FORMICINAE.

ACROPYGA (RHIZOMYRMA) WHEELERI, new species.

Worker.—Length, 1.50 mm.

Head subrectangular, a little longer than broad and as broad in front as behind, with very feebly convex sides, occipital border shallowly excised at middle. Clypeus convex, truncate at anterior border. Frontal area distinct and triangular. Mandibles with distinct basal and apical borders, blades with three strong, triangular teeth, the apical the largest and the basal the smallest. Eyes small, composed of one facet, situated at anterior third of sides of head. Antennae 9-jointed, scapes attaining occipital border; first funicular joint as long as the second and third together, joints 2–5 strongly transverse, joints 6–7 about as long as broad, terminal joint compressed, nearly as long as the three preceding joints together. Thorax robust. Pronotum broader than long, broadest behind middle, sides rounded. Mesonotum longer than broad and about as long as pronotum. Base of epinotum more than twice as broad as long at middle, in profile about one-fourth as long as the sloping declivity into which it gradually rounds. Scale well developed, erect, less than half as long as the epinotal declivity and more than half as broad, compressed anteroventrally and with flattened surfaces, dorsal border rounded.

Shining, delicately shagreened. Hairs very fine, short and abundant on head, longer and sparser on the body.

Pale brownish yellow throughout, except the mandiblar teeth, which are brown.

Hairs yellow.

Female.—(deälated). Length, 2 mm.

Head shorter than in worker. Second funicular joint longer than broad and joints 4–5 less transverse than in the worker. Scale rather thick in profile.

Eyes and ocellar patch brown.

The remainder similar to worker, with the usual sexual modifications.

Type locality.—Honduras: Lombardia.

Cotypes.—Cat. No. 24468, U.S.N.M.

In the small size of the eyes and in the collapsible nature of its tegument, *wheeleri* resembles *exanguis* Wheeler from Mexico. The latter species has the mandibles more slender and without indication of basal and apical borders, the apical antennal joints are broader than in *wheeleri*, and the body, except the anal segments of the gaster, is devoid of erect pile, but is covered with rather sparse pubescence.

PRENOLEPIS (NYLANDERIA) STEINHEILI Forel.

Honduras: Lombardia, Tela.

CAMPONOTUS (MYRMOTURBA) ABDOMINALIS (Fabricius), subspecies STERCORARIUS Forel.

Honduras: Ceiba.

Nesting at bases of coconut fronds.

CAMPONOTUS (MYRMOTURBA) ABDOMINALIS (Fabricius).

Honduras: Tela, San Juan Pueblo.

CAMPONOTUS (MYRMOTURBA) ABDOMINALIS (Fabricius), subspecies STERCORARIUS Forel.

Honduras: San Pedro Sula, Choloma.

CAMPONOTUS (MYRMOBRACHYS) LINDIGI Mayr.

Honduras: Choloma.

CAMPONOTUS (MYRMOCRACHYS) PLANATUS Roger.

Honduras: Ceiba, San Pedro.

Nests in hollow twigs and is especially abundant in scrub growth along the edge of forests and in clearings.

CAMPONOTUS (MYRMOMBLYS) CLAVISCAPUS Forel variety SUBCARINATUS Forel.

Honduras: Ceiba, Choloma, Lombardia.

Nesting, similar to typical form, in hollow twigs.

CAMPONOTUS (MYRMOMBLYS) NOVAGRANADENSIS Mayr.

Honduras: Lombardia, Ignacio, Cecilia, Tela, San Pedro Sula.

Nests in hollow twigs.

CAMPONOTUS (MYRMOPONIS) SERICEIVENTRIS Guerin, subspecies REX Forel.

Honduras: Ceiba, Lombardia, Carmelina, Progresso, Tela.

This species is especially conspicuous about recently felled trees.

CAMPONOTUS (MYRMORHACHIS) RECTANGULARIS Emery.

Honduras: San Juan Pueblo.

CAMPONOTUS (MYRMORHACHIS) QUADRILATERUS Mayr, variety HONDURIANUS, new variety.

Worker.—Length 3.75 mm.

Differing from the typical form (compared with a specimen from Bolivia, ex. coll. Emery) in the color of the legs, which have the middle and hind coxae, trochanters and base of tibiae bright lemon yellow, the anterior tibiae, the tarsi, and the antennae (except the apical third of funiculus) are light yellow brown.

Type locality.—Honduras: Carmelina.

Cotypes.—Cat. No. 24469, U.S.N.M.

A single small colony found in hollow twig.

The color of the soldier is similar to that of the worker and probably differs in the same way from that phase of the typical *quadrilaterus.*

DENDROMYRMEX FABRICII Roger.

Honduras: Ceiba.

DESCRIPTION OF THE SKULL OF MEGAPTERA MIOCAENA, A FOSSIL HUMPBACK WHALE FROM THE MIOCENE DIATOMACEOUS EARTH OF LOMPOC, CALIFORNIA.[1]

By Remington Kellogg.

Of the Bureau of Biological Survey, Department of Agriculture.

INTRODUCTION.

In the summer of 1919 the United States National Museum received through the United States Geological Survey a skull of a Miocene whale, which had been presented by the Celite Products Company, Lompoc, California. More recently the writer was enabled to visit this particular locality, and through the courtesy of E. B. Starr and Edward J. Porteous, of the company, he was shown the exact position where the skull was excavated. The beds of diatomaceous earth at Lompoc furnish a very extensive marine fauna, composed mainly of fishes and to a less extent of birds, cetaceans, and pinnipeds. A very interesting account of the locality has recently been published by David Starr Jordan.[2]

In preparing to study the Tertiary Cetacea of the Pacific coast of North America, the writer had occasion to examine the literature relating to the described forms. The two principal accounts of the finding of fossil whales of the family Balaenopteridae in California are very brief, and without having examined the original specimens one can not be certain that the identifications are correct. In 1872 Cope[3] recorded the occurrence of *Eschrichitus davidsonii* in a formation assumed to be of Miocene Age at San Diego, California. Some years later Stephen Bowers[4] announced the discovery of *Escrichtius davidsoni* [= ? *Balaenoptera davidsoni* Scammon[5]] associated with other Pleistocene mammals at Ventura, California.

---

[1] This paper has been prepared in the course of a study on the fossil cetaceans of the Pacific coast and is published here in advance of a final monograph on the subject. This study has been made possible by a grant from the Carnegie Institution of Washington and is being carried on under the direction of Dr. John C. Merriam.

[2] Jordan, D. S., A Miocene catastrophe, Natural History, vol. 20, no. 1, pp. 18–22, with illus., New York, Jan.–Feb., 1920.

[3] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia, pp. 29–30, 1872.

[4] Bowers, S., American Geologist, vol. 4, p. 391, 1889.

[5] Scammon, C. M., Proc. Calif. Acad. Sci., vol. 4, no. 20, pp. 269–270, San Francisco, Oct. 4, 1872.

On account of the early coosification of nearly all the bones in the basicranium and the obliteration of the sutures, it is usually difficult in adult skulls to determine their margins and relations. This skull (Cat. No. 10300, U.S.N.M.) belonged to an immature individual and fortunately some of the sutures are still visible. Most of the fossil genera allied to *Megaptera* are based either upon mandibles or vertebrae, and since this form is known only from a skull no comparisons are made with any of the previously described forms. It is by no means certain, however, that some of the previously proposed genera allied to *Megaptera* are valid, and in this connection attention is directed to the two following closely related, if not identical genera: *Megapteropsis robustus*[6] was proposed by Van Beneden for a mandible found at Wyneghem, Belgium, while a nearly complete vertebral column from Antwerp was designated by the same author as the type of *Burtinopsis similis.*[7] These two genera were considered by Herluf Winge[8] to be identical with the genus *Megaptera.*

The discovery of this Miocene member of the Mystacoceti gives additional force to the views of those who have advocated the great antiquity of the Cetacea. It is now evident that a highly specialized humpback whale existed during the Lower Miocene off the Pacific Coast of North America, which affords further evidence for assuming that the evolution of the Cetacea has taken a longer period than has heretofore been considered plausible because of certain anatomical characters possessed by the living cetaceans.[9] Along this line there is considerable evidence from the structure of the periotic which, although not conclusive, is at least strongly suggestive. It is stated by Gray[10] that "in both the Cetacea and the Sirenia the cochlea is of a very primitive type." Further study of the auditory apparatus of whales may reveal some interesting evidence bearing on the antiquity of these forms.

Megaptera miocaena is based upon an incomplete skull in which the anterior half of the rostrum and part of the right side of the skull were cut off and lost, the block containing that portion having been carted off to the brick plant before the true nature of the find was fully known. The ventral surface of the skull is crushed in across the palatal region, and some of the thinner bones are so brittle and soft that they disintegrated during shipment from the field to Washington.

---

[6] Van Beneden, P. J., Bull. Acad. Roy. Sci. de Belgique, ser. 2, vol. 34, p. 15, Brussels, 1872.

[7] Idem, pp. 19–20.

[8] Winge, H., Vidensk. Meddel. fra den naturhist. Foren. i Kjøbenhavn for 1909, pp. 1–38, 1910.

[9] Weber, M., Die Saugetiere, pp. 126, 562, 571, 580–582, Jena, 1904.

[10] Gray, A. A., The labyrinth of animals, vol. 2, pp. 22–23, London, 1908.

I am indebted to Mr. Charles W. Gilmore, of the Department of Vertebrate Palaeontology of the United States National Museum, for the opportunity to describe this specimen, and wish to express my cordial thanks to him for this privilege and for the kindly interest he has shown. The drawings in the text have been carefully made by Mrs. Frieda Abernathy, under the supervision of Mr. E. L. Furlong.

DESCRIPTION OF SPECIES.

MEGAPTERA MIOCAENA, new species.

Type.—Cat. No. 10300, U.S.N.M. This specimen consists of an incomplete skull, including the posterior (cranial) region, the squamosals, the supraorbital processes of the frontals, and the posterior half of the maxilla on the left side. The palatal region and the scaphoid fossae are imperfect, while most of the rostrum as well as the maxilla on the right side are missing. The external side of the right tympanic was badly broken, though a sufficient number of fragments were located to enable accurate restoration of this element. The right periotic is practically perfect.

Type locality.—In uncharted township one-half mile northwest of northeast corner of township 6 north, range 34 west (Lompoc Quadrangle), on top of divide between drainage of San Miguelito Creek and Salsipuedes Creek, 3 miles south and east of Lompoc, Santa Barbara County, California.

Horizon.—The skull was first discovered by workmen quarrying diatomaceous earth, about 150 feet below the exposed surface of the bed. As considerable erosion had occurred at this point and as the beds are approximately 1,000 feet thick, it will be impossible to state the exact level until the base of the bed is reached in the course of operations of the Celite Products Company. These beds of diatomaceous earth are considered to be equivalent to the Temblor or Lower Miocene. This specimen was excavated and packed for shipment to Washington, District of Columbia, on July 15, 1919, by W. S. W. Kew, of the United States Geological Survey, assisted by Edward J. Porteous, of the Celite Products Company.

SKULL.

In the present paper it is proposed to give a detailed description of certain bones in the skull. As will be observed from the description, this skull exhibits some interesting characters for a humpback whale. In comparison with other members of the Balaenopteridae, the skull (pl. 1) is remarkably broad and flat when viewed from below, approaching *Megaptera nodosa* more closely than any other known fossil or living whale.

The most obvious peculiarity of this skull is the relatively greater width of the rostrum, which, instead of being narrow and tapering, as in *Megaptera nodosa*, is proportionately broader at the base and possibly slightly shorter. This inference is drawn from the curvature of the rostrum as seen from a dorsal view. The preorbital and postorbital portions of the supraorbital process of the frontal do not over-roll the optic fossa so completely in *Megaptera nodosa.* In the latter form the internal portion of this fossa is completely roofed over by these processes. The exoccipitals are rather large and rounded, while in the skull of the living humpback whale they are somewhat compressed; their appearance in the latter indicates that in the course of time they have become reduced in size and flattened up against the external auditory meatus on the squamosal. The descending lateral processes of the basioccipital are considerably developed, appearing much more conspicuous than in the living forms of *Megaptera.* The tympanic and periotic of the living humpback whale, *Megaptera nodosa*, exhibit only minor modifications of the type that is found in this Miocene *Megaptera.*

MAXILLAE.

The maxilla is a very large bone, whose dorsal plate forms the greater part of the rostrum and whose ventral plate takes a prominent part in roofing over the oral cavity. On the dorsal surface it does not extend posteriorly beyond the base of the nasals. The internal margin of the dorsal plate is in contact with the premaxilla for almost the entire length, receiving the facial process of the latter in a shallow groove along the edge, though this groove is restricted to the posterior end of the maxilla.

The lateral border of the maxilla is thin and bladelike, differing here but slightly in contour as well as in general proportions from *Megaptera nodosa.* In ventral view, the posterior extremity of the maxilla is observed to be very thin, ending in a sharp-edged plate. Pressure exerted by the overlying beds has crushed in the center of this skull, and as a result this portion of the maxilla is closely appressed to the supraorbital process of the frontal. In a perfect skull this part of the maxilla will no doubt be found to be very much like that in a skull of *Megaptera nodosa* (Cat. No. 21492, U.S.N.M.), which was figured by True.[11] This horizontal ventral plate of the maxilla is marked by shallow curved grooves for lodging the bases of the blades of baleen which depend from the roof of the mouth. Just anterior to the preorbital process at the lateral extremity of the supraorbital there is present an indentation in the maxilla for the reception of the jugal. The latter is missing in this specimen, and the zygoma has been restored on plate 2 from a recent *Megaptera nodosa.* No trace of an alveolar gutter for rudimentary teeth can be found along the lateral margin of the maxilla.

---

[11] True, F. W., The whalebone whales of the western North Atlantic, Smithsonian Contrib. to Knowledge, vol. 33, pl. 30, fig. 2, Washington, D. C., 1904.

PREMAXILLAE.

The premaxillae are more slender than *Megaptera nodosa*, but are otherwise closely similar so far as can be determined from the fragments which were preserved with the skull. Posteriorly these bones send back long facial processes, which are lodged in grooves on the upper internal margins of the maxillae, as well as in deep paired grooves on the anterior margin of the combined frontals. The premaxillae are bent downward internally as they approach the nasals, being closely appressed to the maxillae, and form in this region the lateral borders of the nasal openings.

NASALS.

In most respects the nasal is similar to that of *Megaptera nodosa.* It is short in proportion to the length of the rostrum, concave from side to side, and curves ventrally. The free extremity of the nasal is slightly expanded and abruptly truncated. The paired nasals form the posterior border of the nasal openings.

FRONTALS.

The frontals are much reduced in extent on the vertex, being overridden by the supraoccipital posteriorly and the maxillae and nasals anteriorly. In a middle line in front the combined frontals send forward a wedge-shaped process which separates the nasals posteriorly, and on the left side external to this process there are present two deep grooves, separated by a thin septum, for lodging the posterior end of the premaxilla. Laterally the frontals suddenly widen out to form broad and massive supraorbital processes, though at a lower level than the vertex, and afford complete osseous roofs for the orbits. The supraorbital process slopes forward; its posterior margin is greatly thickened and curves sharply downward at right angles to the roof.

Ventrally the preorbital and postorbital processes are prolonged downward in a gentle convex curve inclosing the optic fossa. The postorbital margin of the supraorbital process is prolonged into a thin ventrally directed plate, though it apparently did not meet the blunter and similarly directed plate of the preorbital margin to arch over completely the optic fossa. A further difference from *Megaptera nodosa* lies in the exposure of the optic surface of this element for its whole extent, even though there is a conspicuous overrolling on the part of both preorbital and postorbital plates, with the result that the orbital roof is reduced to a narrow triangle on the external half. The descending process of the frontal, a continuation of the preorbital plate, does not abut against the external pterygoid.

The floor of the orbit can only be surmised by a comparison with *Megaptera nodosa*, since both jugals are wanting.

SUPRAOCCIPITAL.

As a whole the occipital region narrows toward the vertex. The supraoccipital by itself forms practically the entire posterior and upper part of the skull roof, extending up to the vertex to meet the frontals; in the middle line it bears a low, flattened ridge, which is plainly visible even though the supraoccipital has been slightly crushed anteriorly. The ridge is more conspicuous and increases in prominence toward the condyles, while it stops before reaching the frontals. On either side of this low ridge, the supraoccipital is gently concave from side to side. The parietals are in contact inferiorly with its lateral borders.

PARIETALS.

From a dorsal view the parietals are barely visible on the top of the skull, their median parts being concealed by the protruding edges of the supraoccipital. They do not enter the vertex and appear in the temporal fossae as narrow wedge-shaped bones partially limited anteriorly by the supraorbital processes of the frontals and ventrally by the external pterygoids. However, the parietal does override the frontal above the great supraorbital expansion of this bone for some distance forward, extending beyond the vertex.

The parietal of *Megaptera miocaena*, like that of *Megaptera nodosa*, is in contact with the glenoid process of the squamosal, the superior margin of the external pterygoid process of the alisphenoid, and overrides the supraorbital process of the frontal.

ALISPHENOID.

As a result of a careful study of three skulls of *Megaptera nodosa*, one a very old adult (Cat. No. 14409, U.S.N.M.), the second a mature individual (Cat. No. 21492, U.S.N.M.), and the third a young female (Cat. No. 17252, U.S.N.M.), it was concluded that the ala temporalis, or alisphenoid, is excluded from the temporal fossa by the inferior margin of the parietal overlapping its exposed surface. The examination of a skull of a young *Balaenoptera* in which the sutures were still visible confirms this assumption to some extent.

A close examination of the relative outlines of the various elements forming the internal wall of the temporal fossa of this fossil whale adds additional support to this view. The sutures of the small wedgelike ala temporalis, or alisphenoid, in the right temporal fossa are nearly obliterated, while the same element on the left side had either coalesced with the parietal or is concealed by it.

OCCIPITAL CONDYLES.

The occipital condyles, which project considerably and are borne on very short condylar processes, are relatively large, equaling in general proportions those of *Megaptera nodosa.* They are subhemispherical in outline, uniformly convex dorso-ventrally, and the internal margins gradually converge ventrally. The vertical diameter is almost twice that of the horizontal. The external margins of the condyles are set off from the exoccipitals by shallow concavities and the condyles themselves slope strongly from the internal to external margins.

EXOCCIPITALS.

The exoccipitals comprise the greater portion of the posterior end of the skull. Above they are coalesced with the supraoccipital, and laterally they are in contact with the posterior margins of the squamosals, while below they are fused internally with the basioccipital. The exoccipitals are large and rounded, appearing much more massive than those of *Megaptera nodosa.*

BASIOCCIPITAL.

The basioccipital, on account of the knoblike lateral processes, bears a close resemblance to the same element in the basicranium of *Rhachianectes glaucus.* It is a very broad bone, with ventral surface concave from side to side, and is terminated posteriorly by the paired occipital condyles. The anterior margin is ankylosed to the basisphenoid. The sutures between the basiocipital and exoccipital are closed, making it very difficult to determine their boundaries. On each side anteriorly there descends from this element an expanded and rounded process, which serves as part of the external wall for the tympano-periotic cavity. In this respect, it resembles *Rhachianectes glaucus.* Anteriorly these rounded processes are in contact with the vaginal processes of the internal pterygoids.

SQUAMOSALS.

The squamosal is exceedingly large, firmly fixed to the side of the skull, and internally forms part of the wall for the cranial cavity. In ventral view, the posterior and outer part of the squamosal is produced downward into a great trihedral pillar. The glenoid surface of the squamosal is wide and concave from side to side. The rounded and heavy postglenoid process is directed more downward than backward. Behind the glenoid surface the squamosal exhibits a comparatively low, and folded-backward bladelike ridge, between which and the trihedral pillar is a broad, deep channel, while behind this ridge, or rather between it and the exoccipital, there is a shallower and narrower groove concealed by the aforementioned ridge. This broad, deep channel on the squamosal posterior to the glenoid surface is the groove for the external auditory meatus, which continues its course outward by winding around the postglenoid process of that bone. The stout zygomatic process projects laterally and anteriorly to articulate with the jugal and with the postorbital process of the frontal. The petrous portion of the squamosal overrides the descending lateral wing of the basisphenoid.

BASISPHENOID.

The basisphenoid is a wholly flat bone, probably entirely concealed by the expanded wings of the vomer. By removing a portion of the overlying vomer it was found that the presphenoid is permanently separated from the basisphenoid by an open transverse suture. Two horizontal processes arise from the anterior end of the basisphenoid, one of which is the ala temporalis; the other appears on the surface of the temporal fossa as the external pterygoid. The descending lateral wing of the basisphenoid unites with the petrous portion of the squamosal to form the anterior margin of the tympano-periotic recess.

VOMER.

Since one side of the palate has been destroyed, one is permitted to trace the course of the vomer for most of its extent. The vomer, judging from the exposed surface on the right side of the skull, is more expanded in the rostral region, where the maxillae abut upon it by their rounded margins, than near the palatines, where the former have commenced to conceal it with their marginal plates. The curvature and outlines of a section of the vomer, 14 inches in length from the rostral region, bears out this impression.

The vomer, which presumably was partially concealed by the palatines, again makes its appearance at the point where these bones commence to diverge from one another. It is characterized here by a prominent carina similar to that which separates the palatines in the living *Megaptera nodosa*, while posteriorly it gradually diminishes in height toward the base. The loss of the posterior margin of the vomer prevents the determination of the point where the carina disappears. Laterally the vomer is in contact with the vaginal processes of the internal pterygoids.

PALATINES.

It is difficult from the present specimen to secure anything like an adequate idea of the shape or relationships of the palatines to the adjoining bones. The skull has been considerably crushed inferiorly in the palatal region, as mentioned previously, and as a result the maxillary-palatine sutures and the true outlines of the palatines are somewhat obliterated. The imperfectly preserved palatine overrides the carina of the vomer to a greater degree than is normal in *Megaptera nodosa*, and may possibly have been fused medially to its adjoining mate. A careful comparison of this palatine with the same element in skulls of *Megaptera* and *Balaenoptera* shows that this coalescence is a modification of rare occurrence except possibly in *Balaenoptera borealis*.

PTERYGOIDS.

The pterygoids are apparently the most delicate bones in the basicranial region of the skull, and for this reason they are often found to be damaged in fossil specimens. The imperfect state of preservation of the scaphoid fossae of this skull prevents one from describing with any degree of certainty the correct outlines of the bones forming the ventral surfaces.

These fossae are large and well defined, ovoidal in outline and comparable in size to those of a young *Megaptera nodosa*. It is stated by von Schulte[12] that the so-called pterygoid fossa can not correctly be called such in *Balaenoptera borealis* and that this cavity should be known as the scaphoid fossa.

The internal pterygoid commences posteriorly at the anterior margin of the lateral swelling of the basioccipital and is bounded internally by the expanded wings of the vomer. The hamular processes on both sides are destroyed, though the curvature of the descending portion of the internal pterygoids at the fracture indicates that they curved internally and horizontally. The roof of the scaphoid fossa is formed in part by the internal pterygoid, though this element is so intimately ankylosed to the external pterygoid process of the alisphenoid that accurate determination of their boundaries is impossible. Von Schulte's statement, as well as his figures[13] of the external pterygoid process of the alisphenoid in the embryo of *Balaenoptera borealis*, are of unusual interest in view of the fact that previous workers considered this element to be the ala temporalis, or alisphenoid. In the nasal fossa the vaginal process of the internal pterygoid plate is joined to the vomer by suture.

In the temporal fossa the external pterygoid process of alisphenoid joins by suture the vertical plate of the palatine and is in contact with the postorbital process of the supraorbital. The foramen ovale is situated in an aperture formed between the diverging glenoid and the falciform processes of the squamosal at their line of union with the posterior termination of the external pterygoid process of the alisphenoid, and more internally is partially bounded by the descending lateral wing of the basisphenoid. The external pterygoid process probably forms the floor of the scaphoid fossa.

---

[12] Schulte, H. von W., Anatomy of a foetus of *Balaenoptera borealis*, Mem. Amer. Mus. Nat. Hist., n. s., vol. 1, pt. 6, pp. 476–477, New York, March, 1916.

[13] Idem, p. 476, pl. 44, fig. 2.

Just posterior to the scaphoid fossa is a funnel-shaped recess which enters the cranial cavity. It is bounded internally by a conspicuous lateral swelling of the basioccipital, which forms a rounded knob; posteriorly by the exoccipital; and externally by the squamosal. In this cavity the fused tympanic and periotic is lodged.

A well-marked groove leads downward from this cavity, follows the external side of the basioccipital, and makes a deep groove in the exoccipital, where it terminates on the surface. This is the large posterior lacerated foramen.

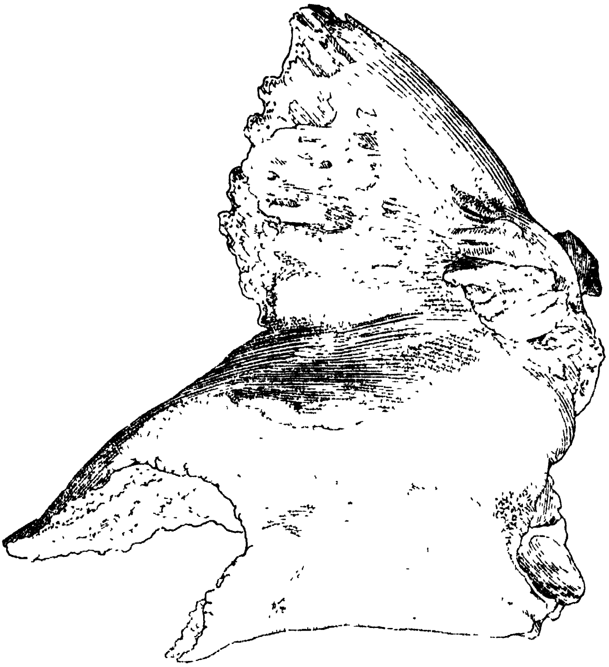


FIG. 1.—DORSAL VIEW OF RIGHT PERIOTIC OF MEGAPTERA MIOCAENA × 1, CAT. NO. 10300, U. S. N. M.; LOMPOC, CALIFORNIA.

PERIOTIC.

As it is not the object of the present paper to go into an explanation of the homologies of the elements comprising the periotic, a discussion of this is omitted, and the terminology adopted is based upon the work of Lillie[14] in 1910.

The periotic bone is irregularly V shaped, the apex or opisthotic is not complete, while the anterior, or proötic, resembles a compressed three-sided pyramid. On the dorsal face (fig. 1) the proötic is separated from the labyrinthic region by a broad and rather deep groove, into which the inner edge of the wedge-shaped ridge, formed by the fused processes of the basisphenoid and squamosal, is received, and which in turn serves to lodge the periotic more firmly. The dorsal surface of the proötic is closely applied to the petrous portion of the squamosal, while the anterior margin is in contact with the external pterygoid process of the alisphenoid.

---

[14] Lillie, D. G., Observations on the anatomy and general biology of some members of the larger Cetacea. Proc. Zool. Soc. London for 1910, pp. 769–792, pl. 74, text figs. 69–78 [discussion of auditory organ of *Balaenoptera*, pp. 776–781, text figs. 71–72, pl. 74].

The proötic is not clearly differentiated from the opisthotic, for these elements are so fused as to be unrecognizable as separate elements.

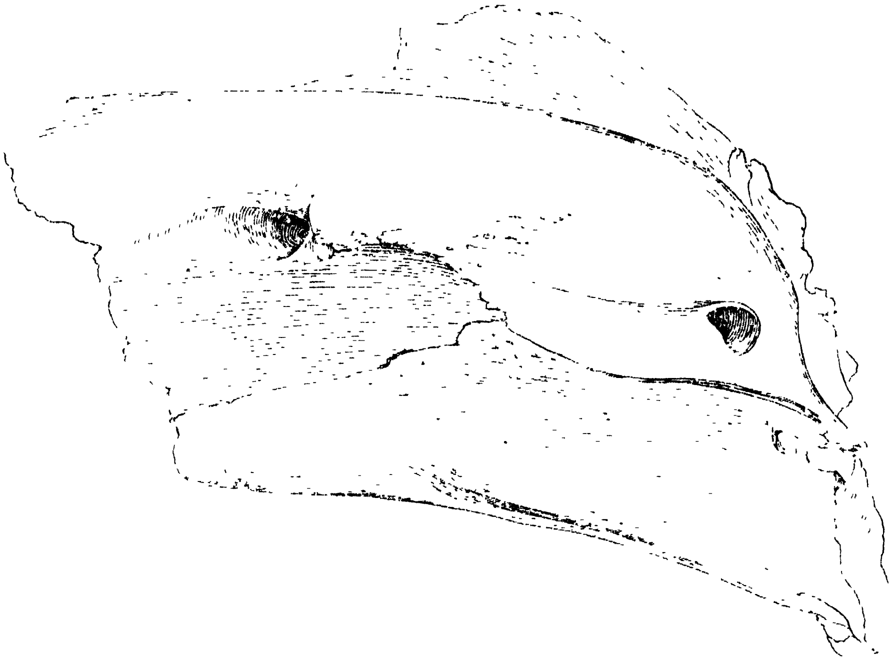


FIG. 2.—POSTERIOR VIEW OF LEFT PERIOTIC OF MEGAPTERA NODOSA × 1, CAT. NO. 21492, U.S.N.M.; CAPE COD, MASSACHUSETTS.

The posterior process or opisthotic, as previously mentioned, was broken off when the periotic was removed from the skull for study. The apophysis of the opisthotic fits snugly into the groove that lies just posterior to the open channel for the external auditory meatus. It was impossible to remove the apophysis without doing serious damage to the skull and hence it was not figured with the remainder of the periotic bone. The entire external prolongation of the opisthotic of *Megaptera nodosa* is not shown in figures 2 or 4.

On the ventral face of the proötic (fig. 3), near the posterior end, there is a rounded depression to which the pedicle of the anterior extremity of the tympanic bone is ankylosed. According to previous investigators, it would appear that the processus gracilis of the malleus is fused with a rounded projection on the tympanic near the posterior end. As most of the posterior pedicle is wanting on both of these fossil tympanics, this bone will not be discussed further. In figure 5 the posterior pedicle has been restored to show its relations with the periotic. However, the posterior pedicle is somewhat shorter than is shown in this figure for it rests against the inferior surface of the apophysis of the periotic and not against the broken base of that process as shown in figure 5. No incus was found with this auditory apparatus. Doran,[15] in his notable memoir on the ossicula auditus, figures the incus of *Balaenoptera mysticetus* (pl. 62, fig. 29), but states that he has neither examined nor found a detailed description of the incus of *Megaptera.*[16]

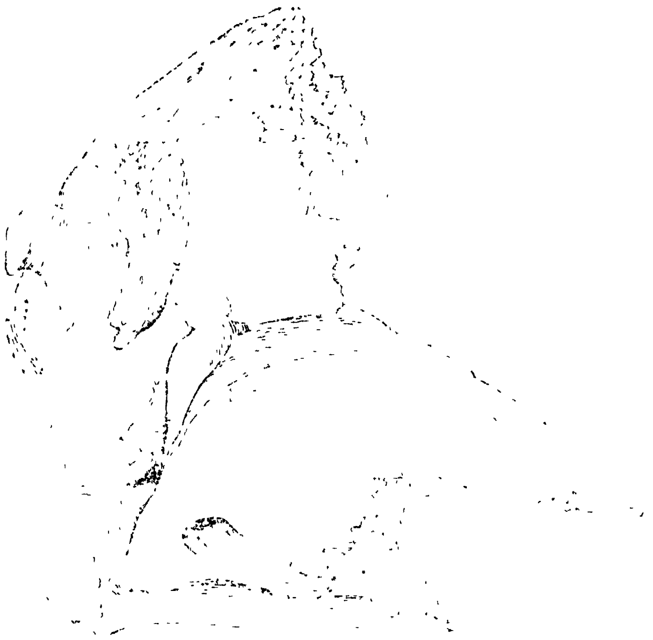


FIG. 3.—VENTRAL VIEW OF RIGHT PERIOTIC OF MEGAPTERA MIOCAENA × 1, CAT. NO 10300, U.S.N.M.; LOMPOC, CALIFORNIA

A long, slender stapes is present in the fenestra ovalis of the right periotic (fig. 6), which is more slender and relatively longer than that of *Balaenoptera physalus*. No stapes of *Megaptera* was available for comparison. The base of the stapes is soldered to the fenestra ovalis. An effort was made to dislodge this bone for accurate study, but this plan was given up when it became evident that such a procedure would probably result in the breaking or destruction of the stapes. The head of the stapes is oval. The crura are long and fairly straight, while the aperture is smaller than in *Balaenoptera physalus*, or *B. musculus*.

---

[15] Doran, Alban H. G., Morphology of the mamalian ossicula auditus, Trans. Linnean Soc. London, ser. 2, vol. 1, pt. 7, pp. 371–497, pls. 58–64.

[16] Idem, p. 455.

Just behind the depression for lodging the pedicle of the tympanic is the facial canal, a groove running in a transverse direction, which is very similar in position and shape to that of *Megaptera nodosa.* In fact, there is a striking similarity between the entire periotic of *Megaptera nodosa* and the same bone of this fossil. The central or labyrinthic portion of the periotic which incloses the essential part of the auditory organ is so nearly like the corresponding structure in the periotic of *Megaptera nodosa* that a description of one could well apply to the other. The inferior surface of this labyrinthic region is dome shaped. On the posterior surface of this dome there is a slight depression formed in part by the aperture of the fenestra rotundum. A rounded ridge projecting over the internal margin of the facial canal marks the external boundary of the labyrinthic. This same ridge in *Megaptera nodosa* (fig. 4) is considerably flattened posteriorly as well as internally, and forms a floor which extends nearly halfway across the canal. The apertures for the eustachian tube and for the fenestra ovalis in this fossil are

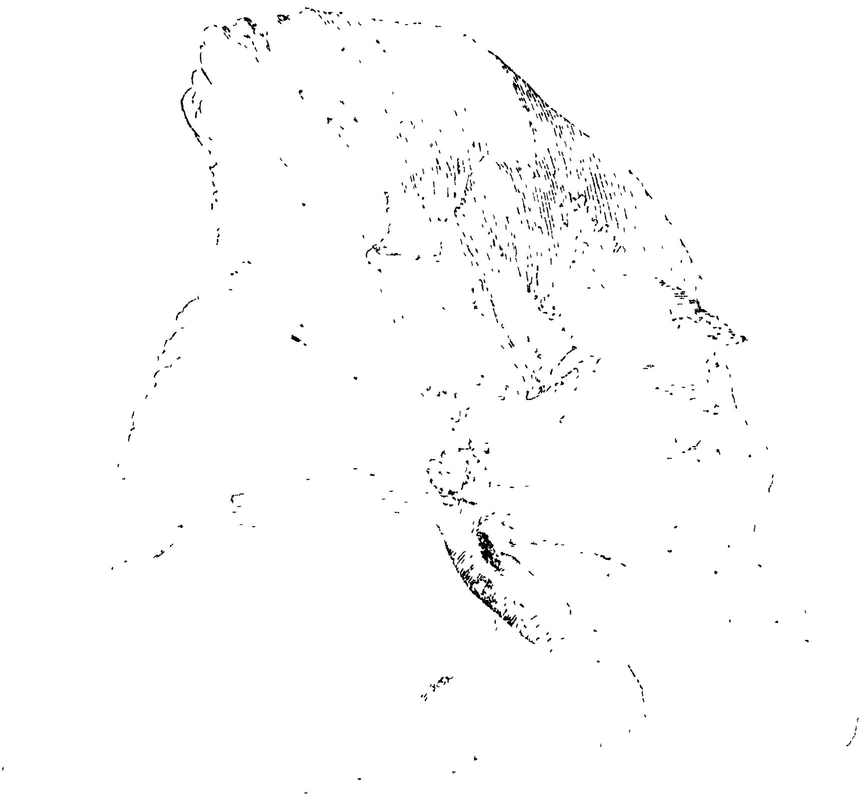


FIG. 4.—VENTRAL VIEW OF LEFT PERIOTIC OF MEGAPTERA NODOSA × 1, CAT. NO. 21492, U.S.N.M.; CAPE COD, MASSACHUSETTS.

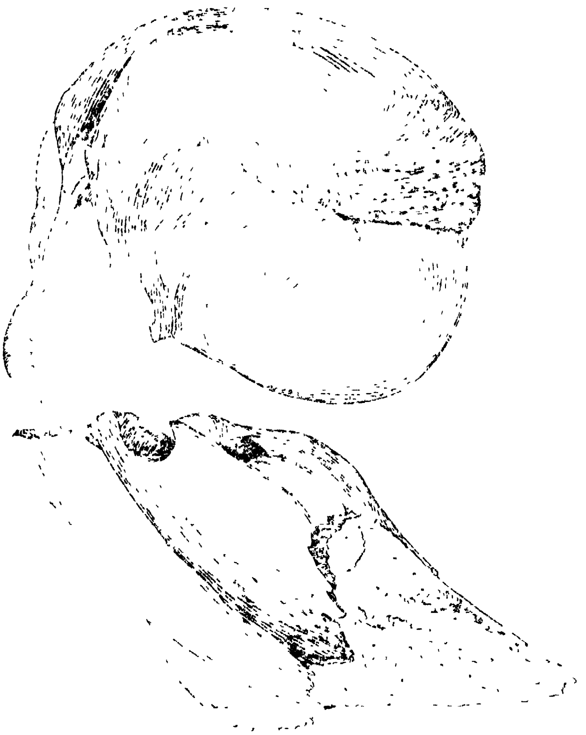


FIG. 5.—POSTERIOR VIEW OF RIGHT TYMPANIC AND PERIOTIC OF MEGAPTERA MIOCAENA IN POSITION × 1, CAT. NO. 10300, U.S.N.M.; LOMPOC, CALIFORNIA.

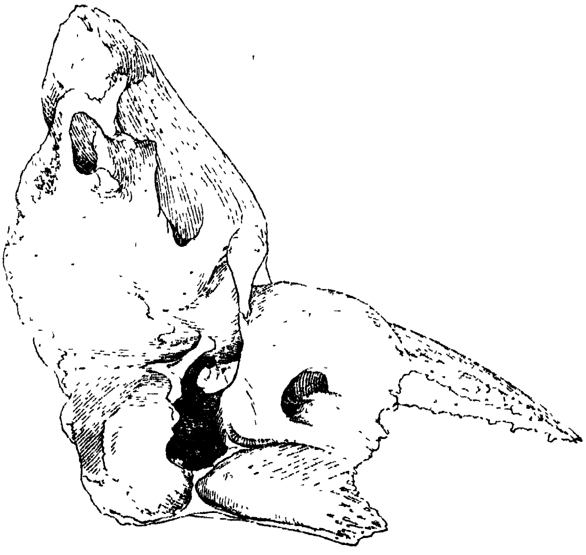


FIG. 6.—LOOKING INTO THE VESTIBULE FROM APEX OF RIGHT PERIOTIC OF MEGAPTERA MIOCAENA × 1, CAT, NO. 10300, U.S.N.M.; LOMPOC, CALIFORNIA.

practically identical in position with those of *Megaptera nodosa*. A similar ridge separates these apertures.

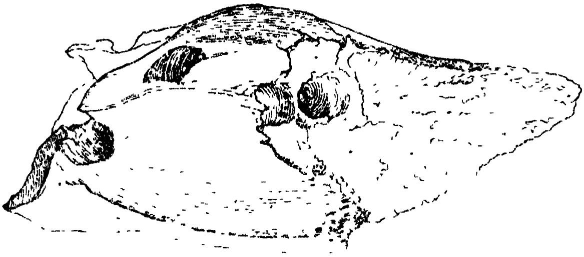


FIG. 7.—POSTERIOR VIEW OF RIGHT PERIOTIC OF MEGAPTERA MIOCAENA × 1, CAT. NO. 10300, U.S.N.M.; LOMPOC, CALIFORNIA.

TYMPANIC.

The tympanic bone is relatively dense and heavy, fastened to the periotic by two thin pedicles (fig. 8) and connected with the fenestra ovalis by a chain of ossicles. In shape and general proportions (fig. 9) it resembles that of *Megaptera nodosa*, though it is, of course, slightly smaller. The outer surface is nearly subquadrate in outline. It differs from *Megaptera nodosa* in the following details:

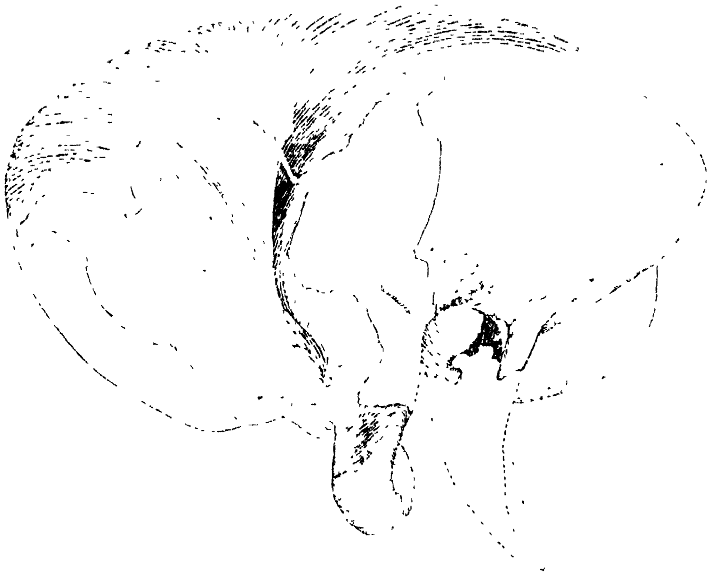


FIG 8.—EXTERNAL VIEW OF LEFT TYMPANIC OF MEGAPTERA MIOCAENA, ABOUT NATURAL SIZE, CAT. NO. 10300, U.S.N.M.; LOMPOC, CALIFORNIA.

The posterior face is indented medially. The anterior face slopes obliquely forward to the external side, while in *Megaptera nodosa* the reverse is true; that is, it slopes obliquely from the external to the internal side. In outline the external side resembles that of the living species, except that in the latter the posterior corner is more abruptly truncated.

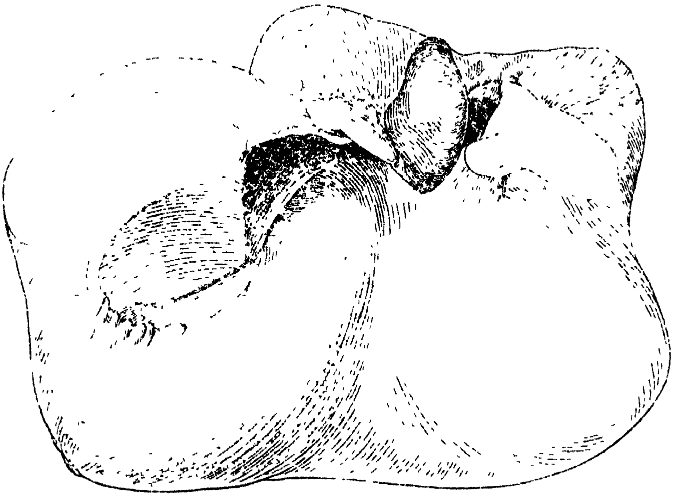


FIG. 9.—DORSAL VIEW OF LEFT TYMPANIC OF MEGAPTERA MIOCAENA, ABOUT NATURAL SIZE, CAT. NO. 10300, U.S.N.M.; LOMPOC, CALIFORNIA.

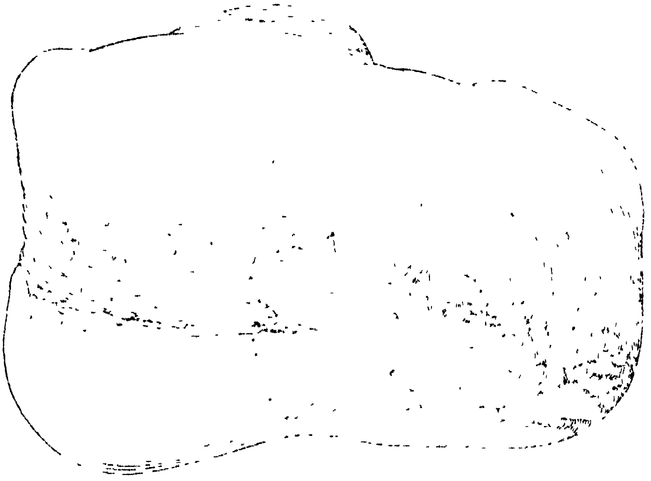


FIG. 10.—INTERNAL VIEW OF LEFT TYMPANIC OF MEGAPTERA MIOCAENA, ABOUT NATURAL SIZE, CAT. NO. 10300, U.S.N.M.; LOMPOC, CALIFORNIA.

TABLE OF MEASUREMENTS.

	Mm.
Breadth of skull across anterior ends of zygomatic processes of squamosals	1,216
Greatest breadth of skull across lateral margins of exoccipitals	788
Greatest transverse width of temporal fossa	388
Greatest antero-posterior width of temporal fossa	167
Greatest ventral length of supraorbital process	461
Greatest antero-posterior diameter of orbit	159
Greatest length of palatine (estimated)	460
Greatest width of basioccipital between tympano-periotic recesses	273
Greatest width between bases of lateral descending processes of basioccipital	88
Greatest antero-posterior length of combined scaphoid and tympano-periotic recess	215
Greatest transverse width of scaphoid fossa	92
Greatest dorso-ventral diameter of condyle	180
Greatest transverse diameter of condyle	101
Breadth of rostrum at base (estimated)	876
Distance from anterior end of nasals to anterior edge of frontals	224
Greatest length of tympanic bulla	93
Greatest width of tympanic bulla	60
Greatest depth of bulla on internal side	50
Greatest depth of periotic in labyrinthic region	35.5
Greatest antero-posterior length of periotic	86
Greatest extero-internal width of periotic	81

EXPLANATION OF PLATES.

PLATE 1.

Ventral view of skull of *Megaptera miocaena.* Cat. No. 10300, U.S.N.M., Vert. Palaeon. Type. The right periotic lies in its normal position. The right supraorbital fragment is not placed in its correct position in this plate.

PLATE 2.

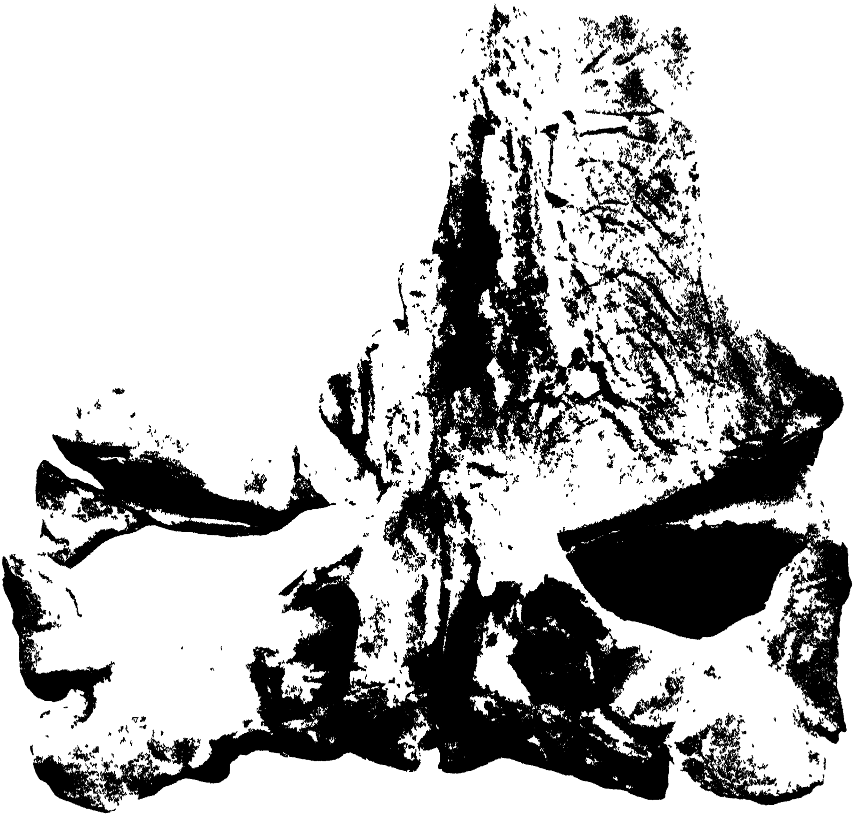
Diagrammatic outline drawing of ventral view of skull of *Megaptera miocaena.* The right side has been restored to show approximate outlines of the missing parts.

PLATE 3.

Dorsal view of skull of *Megaptera miocaena.* Cat. No. 10300, U.S.N.M., Vert. Palaeon. Type.

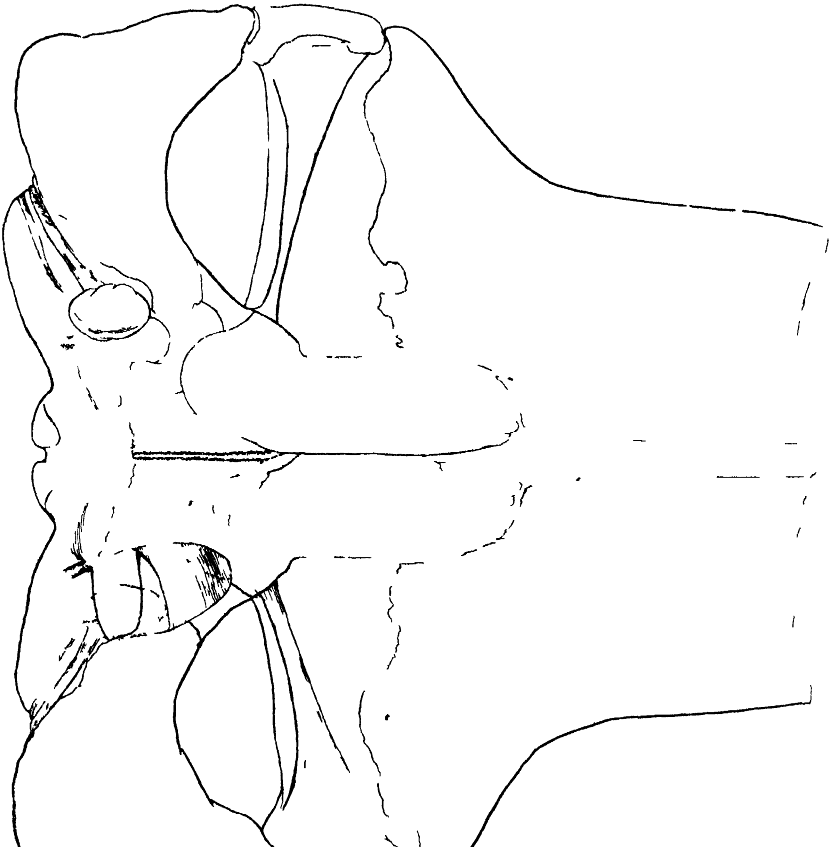
PLATE 4.

Lateral view of skull of *Megaptera Miocaena.* Cat. No. 10300, U.S.N.M., Vert. Palaeon. Type.



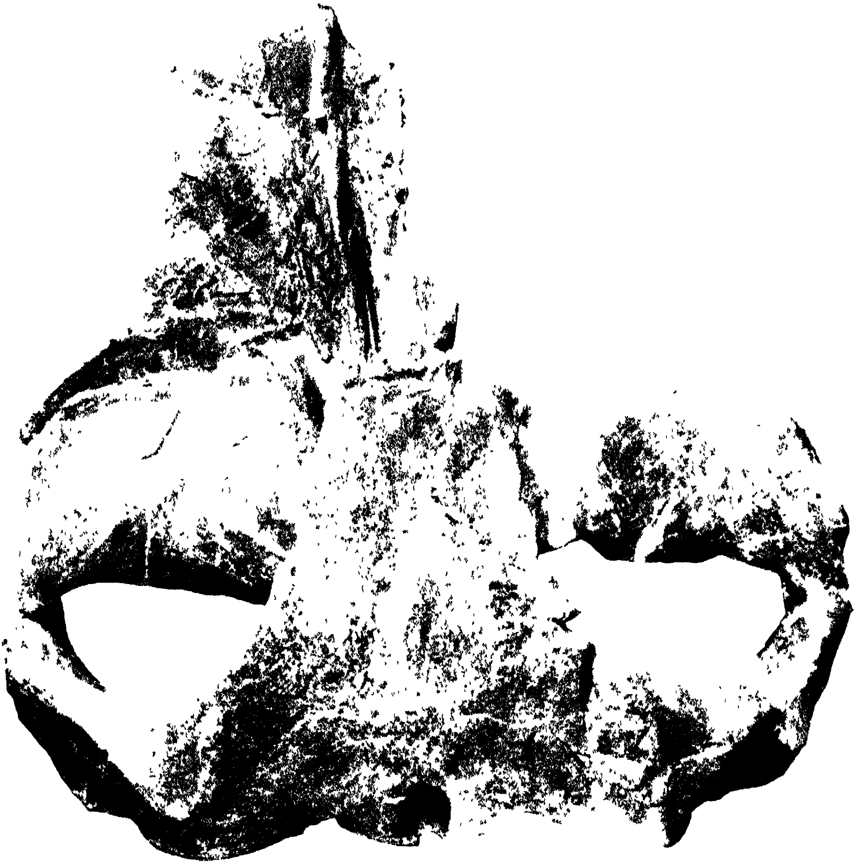
VENTRAL VIEW OF SKULL OF MEGAPTERA MIOCAENA.

FOR EXPLANATION OF PLATE SEE PAGE 13



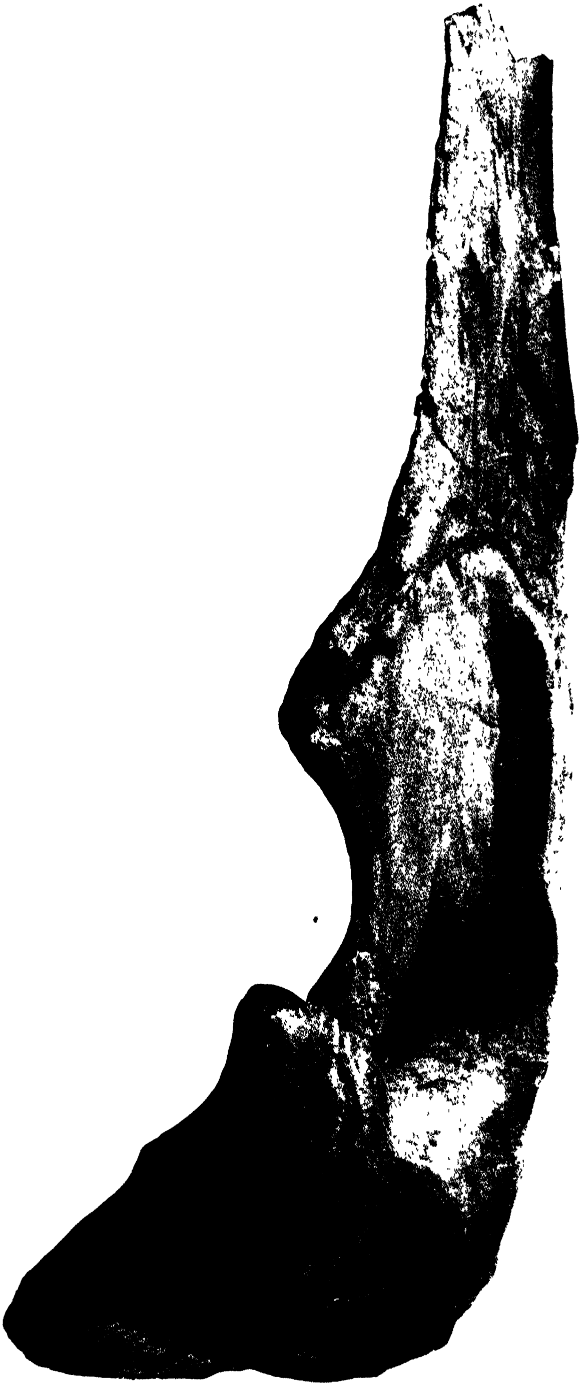
OUTLINE DRAWING OF VENTRAL VIEW OF SKULL OF MEGAPTERA MIOCAENA

FOR EXPLANATION OF PLATE SEE PAGE 18



DORSAL VIEW OF SKULL OF MEGAPTERA MIOCAENA.

FOR EXPLANATION OF PLATE SEE PAGE 18



LATERAL VIEW OF SKULL OF MEGAPTERA MIOCAENA.

FOR EXPLANATION OF PLATE SEE PAGE 18

A REVISION OF THE NORTH AMERICAN ICHNEUMON-FLIES, BELONGING TO THE SUBFAMILIES NEONEURINAE AND MICROGASTERINAE.

By C. F. W. Muesebeck,

Of the Bureau of Entomology, United States Department of Agriculture.

INTRODUCTION.

This paper is a contribution from the Gipsy Moth and Brown-tail Moth Branch of the Bureau of Entomology. It includes tables of the known genera of the braconid subfamilies, *Neoneurinae* and *Microgasterinae*, keys to the North American species, descriptions of new species, and synonymical notes, also figures of the fore wing of representative species of the North American genera known to me.

The two subfamilies are incorporated in this paper, for the reason that one or both of the genera, *Neoneurus* Haliday and *Elasmosoma* Ruthe, which constitute the subfamily *Neoneurinae*, have been quite generally placed in the *Microgasterinae*. This despite the recognition by most workers in the Braconidae that both genera differ very widely in many important respects from typical *Microgasterinae*. Foerster [1] mentioned neither *Neoneurus* nor *Elasmosoma*, but included in the *Microgasterinae* a new genus, *Ecclites*, which Ashmead [2] synonymized with *Neoneurus* Haliday. In his key to the Microgasterides Marshall [3] included *Elasmosoma; Neoneurus*, however, he placed in the Agathides. It will be recalled that Marshall regarded these two groups as tribes of his division Areolaires. Ashmead [2] was apparently the first to recognize the close relationship of *Neoneurus* and *Elasmosoma*. In suggesting that the *Microgasterinae* might be susceptible of tribal division, he indicated that under such an arrangement these two genera would fall together. A few years later Szepligeti [4] again separated the two, holding *Elasmosoma* in the *Microgasterinae*, because of its incomplete radial cell, and placing *Neoneurus* in the *Agathidinae*, now the *Braconinae*. Furthermore he stated [5]

---

[1] Verh. der naturh. ver. preuss. Rheinl., vol. 19, 1862, p. 244.

[2] Proc. U. S. Nat. Mus., vol. 23, 1900, p. 130.

[3] In Andre, Species Hym. Europe et Alg., vol. 4, 1888, p. 389.

[4] Gen. Ins., fasc. 22, 1904, p. 102.

[5] Idem, p. 118.

No. 2436—Proceedings U. S. National Museum, Vol. 61, Art. 15

that in his opinion *Plumarius* Philippi was identical with *Neoneurus* Haliday. Ashmead had placed *Plumarius* in the *Microgasterinae*, near *Neoneurus*, but evidently did not regard it as very similar to this genus. Recently Bengtsson[6] has published an admirable paper, in which he has clearly defined the genera *Neoneurus* and *Elasmosoma*, has shown beyond dispute their intimate relationship, both structurally and biologically, and has erected for them the subfamily *Neoneurinae*. This author points out that Ashmead was undoubtedly wrong in placing *Ecclites* Foerster in synonymy with *Neoneurus*, for Foerster described *Ecclites* as possessing only two cubital cells in the fore wing, while *Neoneurus* has three.

In a consideration of the genera constituting the *Neoneurinae* and the *Microgasterinae*, *Plumarius* can now be disregarded. Recently Dr. J. C. Bradley of Cornell University, on an examination of Philippi's type, found that it is not an ichneumonoid; he will undoubtedly shortly define its systematic position,[7] *Ecclites* Foerster certainly can not be considered a microgasterine genus, and in all probability is not neoneurine. Its position is very doubtful; but I am inclined at present to place it in the *Blacinae*. *Neoneurus* Haliday and *Elasmosoma* Ruthe will make up the *Neoneurinae;* while the *Microgasterinae* will comprise the following genera: *Oligoneurus* Szepligeti, *Mesocoelus* Schultz, *Mirax* Haliday, *Adelius* Haliday, *Dirrhope* Foerster, *Apanteles* Foerster, *Microgaster* Latreille and *Microplitis* Foerster.

The genera *Neoneurus*, *Olingoneurus*, and *Dirrhope*, none of which has yet been discovered in North America, and *Mesocoelus* Schultz, the only known specimen of which was taken on the Island of St. Vincent and is in the British Museum, are known to me only from literature. I have, however, had the opportunity of examining a very large part of the type material of the North American species contained in the remaining genera, most of which is in the United States National Museum. Only the types of the following have not been seen: Of *Microplitis tuckeri* Viereck, which is in the collection of Kansas University; of Provancher's two species of *Microplitis* and four of *Microgaster* which are in the Museum of Public Instruction in Quebec, Canada; of *Microgaster zonaria* Say and *M. calliptera* Say which have been lost; and of *Microplitis coactus* Lundbeck which is probably in some European collection.

Say's two species were sufficiently well characterized in the original description to make their recognition comparatively easy. In

---

[6] Lund. Univ. Arsskr. N. F. Avd. 2, vol. 14, No. 32, 1918, pp. 1–47.

[7] In an address before the Biological Society of Washington, the abstract of which was published in 1921 (Journ. Wash Acad. Sci., vol. 11, No. 9, p. 214), Doctor Bradley said that *Plumarius* belongs to the family Mutillidae and has the genus *Komowiella* André as a synonym.

Microplitis tuckeri Viereck and Provancher's species I have been greatly aided by notes kindly loaned me by Mr. A. B. Gahan, which were made by himself on an examination of the types of these species several years ago.

At this point I wish to thank Mr. A. F. Burgess, in charge of the gipsy moth and brown-tail moth investigations, for making possible the preparation of this paper. I desire also to gratefully acknowledge many helpful suggestions and criticisms on the part of Messrs. Gahan and Rohwer, of the Bureau of Entomology.

CLASSIFICATION.

Superfamily ICHNEUMONOIDEA.

Family BRACONIDAE.

Subfamily NEONEURINAE.

Neoneurinae BENGTSSON, Lunds. Univ. Arsskr. N. F. Avd. 2, vol. 14, No. 32, 1918, p. 46.

Following is a translation of Bengtsson's characterization of this group:

Head broad, short viewed from in front; thorax at least as broad as head, transverse; vertex short; vertex, temples and cheeks immargined; occiput not at all excavated; clypeus truncate anteriorly; labrum prominent, the apex rotundate; eyes smooth; antennae shorter than body, with 13 to 16 segments, the segments distinct; mandibles narrow, crossing at apex, bidentate; palpi very short, concealed, the maxillary 2-segmented, the labial 1-segmented; thorax thick; mesonotum broad, convex, abruptly declivous in front; notauli wanting or weakly indicated. Anterior wings with stigma large, broadly ovate, provided with a slight extension apically, and emitting radius a little before its middle; radius with 3 abscissae, the 1st and 2d very short; radial cell very short, narrow, remote from apex of wing; 3 cubital cells, the 2d small, a little longer than broad, trapezoidal; brachial cell lengthened, acuminate, open, almost twice as long as discoidal; veins often inconspicuous or partly obsolete. Posterior wings with radial cell not divided, discoidal cell wanting, nervellus wanting or not at all distinct. Legs subequal, the posterior pair slightly longer and thicker, tibial spurs long, tarsal claws minute, anterior tarsi of female with greatly elongated pulvilli. Abdomen narrow, sublinear, sessile, flat above, with eight distinct segments, valvula ventralis of female not elongate; ovipositor very short, hardly exserted. Body small, 2 to 4 mm. long.

The *Neoneurinae* differ most strikingly from the *Microgasterinae* in the exceedingly short palpi; the long, slender tarsi, with very minute, usually indistinct, tarsal claws; the smooth eyes; the narrow radial cell, the third abscissa of radius being parallel with the outer margin of stigma; the subquadrate second cubital cell; and the very short thickened metacarpus.

Bengtsson, in the article cited above, gives a concise summary of the published information regarding the biology and habits of members of this group. It appears to have been conclusively shown that the known species pass the larval period as internal parasites of ants. This unusual habit itself will at once set them apart from the *Microgasterinae*, which are evidently exclusively parasitic on lepidopterous larvae.

KEY OF THE GENERA OF NEONEURINAE.

Radial cell complete, the radius distinct to the wing-margin; antennae 16-segmented, and but little shorter than body............ **Neoneurus** Haliday.

Radial cell incomplete, the last abscissa of radius mostly obsolete; antennae 13-segmented in the female, 14 in the male, and very short; porrect, shorter than head and thorax united........................ **Elasmosoma** Ruthe.

Genus NEONEURUS Haliday.

Neoneurus Haliday, Ent. Mag., vol. 5, 1838, p. 213.—Snellen van Vollenhoven, Schetsen, vol. 2, 1869, pl. 6.—Marshall, in André, Hym. Eur. et Alg., vol. 5bis, 1897, p. 197, pl. 10, fig. 3.—Ashmead, Proc. U. S. Nat. Mus., vol. 23, 1900, p. 130.—Szepligeti, Gen. Ins., fasc. 22, 1904, p 118.—Bengtsson, Lund. Univ. Arsskr. N. F. Avd. 2, vol. 14, 1918, pp. 1-47. *Genotype.—Neoneurus halidaii* Marshall (Monobasic).

Head large, transverse, as broad as thorax; maxillary palpi 2-segmented, labial 1-segmented; eyes large but not prominent, bare, converging in female; occiput convex; antennae of both sexes slender, as long as the body nearly, 16-segmented; parapsidal grooves weakly indicated; scutellum separated from mesoscutum by a transverse sulcus; anterior wing with a very short complete radial cell, which is divided by a more or less distinct cross-vein; three cubital cells, the second small, subquadrate; recurrent vein indistinct or incomplete, *the five-sided discoidal cell open outwardly*; legs slender; the posterior trochanters small, almost indistinct; spurs of posterior tibiae half as long as the metatarsus; tarsal claws minute; abdomen sessile, flat and finely shagreened above, keeled below.

Morley[8] was beyond all doubt mistaken in identifying *Neoneurus halidaii* Marshall with *Elasmosoma berolinense* Ruthe. Marshall's characterization and figure show conclusively that the genotype of *Neoneurus* is distinct from that of *Elasmosoma.*

No representative of this interesting genus has yet been discovered in North America; but it is not at all unlikely that further collecting in the immediate vicinity of ants' nests will produce it.

---

[8] Ent. Mag., vol. 50, 1914, p. 16.

Genus ELASMOSOMA Ruthe.

Elasmosona RUTHE, Berlin. Ent. Zeitschr., vol. 2, 1858, p. 7.—MARSHALL, in André, Spec. Hym. Europe, vol. 4, 1888–1890, pp. 389, 549.—ASHMEAD, Proc. Ent. Soc. Wash., vol. 3, 1895, p. 280; Proc. U. S. Nat. Mus., vol. 23, 1900, p. 131.—SZEPLIGETI, Gen. Ins., fasc. 22, 1904, p. 104.—BENGTSSON, Lund. Univ. Arsskr. N. F. Avd. 2, vol. 14, 1918, pp. 1–47. *Genotype.*—*Elasmosoma berolinense* Ruthe (Monobasic).

Paramirax ASHMEAD, Proc. Ent. Soc. Wash., vol. 3, 1895, p. 281. *Genotype.*—(*P. schwarzi* Ashmead)=*Elasmosoma schwarzi* Ashmead (Monobasic).

Head transverse; maxillary palpi 2-segmented, labial 1-segmented; eyes very large, bare; antennae very short and straight, shorter than head and thorax united, 13-segmented in female, 14-segmented in male; mesoscutum without parapsidal furrows; propodeum abruptly declivous; radius with three abscissae, the third mostly obsolete; the radial cell very narrow, open; three cubital cells, the second subquadrate; intercubital veins and cubitus very indistinct; first discoidal cell with very long petiole, and open outwardly, the recurrent vein being absent or very indistinct; inner spur of posterior tibiae nearly as long as metatarsus; tarsi long and slender, tapering gradually toward apex; tarsal claws exceedingly minute, indistinct; abdomen sessile, flat, and minutely shagreened above, rather sharply margined laterally, and with a pronounced ventral keel; hypopygium of female broad and peculiarly bifurcate.

This genus is represented in North America by four species. While no definite host records are available for any of these, all have been taken near ants' nests; and, in view of the observations on the habits of European species, it seems safe to assume that they are parasitic upon ants. All four species appear to be exceedingly uncommon. I have seen not more than four specimens of any of them.

KEY TO THE NORTH AMERICAN SPECIES OF ELASMOSOMA.

1. Abdomen long, slender, about twice as long as head and thorax united, strongly compressed, although flat above; legs including all coxae pale yellow ---------- 1. **schwarzi** Ashmead.
   Abdomen much shorter, but little, or not at all, longer than head and thorax combined, and not so narrow and strongly compressed ---------- 2.
2. Wings distinctly somewhat fuliginous ---------- 2. **pergandei** Ashmead.
   Wings whitish hyaline ---------- 3.
3. Legs, including all coxae, pale yellow; eyes strongly convergent below, the face at base of clypeus much narrower than long down the middle; spiracles of first abdominal segment not prominent -- 3. **vigilans** Cockerell.
   Middle and posterior coxae blackish; eyes not so convergent below, the face at base of clypeus at least as broad as long down the middle; spiracles of first abdominal segment prominent ---------- 4. **bakeri** Ashmead.

1. ELASMOSOMA SCHWARZI Ashmead.

Elasmosoma schwarzi ASHMEAD, Proc. Ent. Soc. Wash., vol. 3, 1895, p. 283.

Type.—In the United States National Museum.

This species is at once distinguished from the other known North American forms by the very long and slender abdomen.

Besides the type which was taken at Washington, District of Columbia, the National Collection contains one female specimen collected by Dr. J. M. Aldrich at Lafayette, Indiana, Aug. 11, 1918. No other specimens of this species are known to me.

2. ELASMOSOMA PERGANDEI Ashmead.

Elasmosoma pergandei ASHMEAD, Proc. Ent. Soc. Wash., vol. 3, 1895, p. 283.

Type.—In the United States National Museum.

The slightly infumated wings readily separate this species from *vigilans*, which it closely resembles.

Known only from the type, collected at Washington, District of Columbia, and one other female specimen in the National Museum labeled "Lawrence, Kansas, Geo. B. King."

3. ELASMOSOMA VIGILANS Cockerell.

Elasmosoma vigilans COCKERELL, Proc. Ent. Soc. Wash , vol. 10, 1909, p. 168.

Type.—In the United States National Museum.

The two female specimens in the type series are exceedingly like *bakeri* Ashmead, of which only males are known, and quite possibly may eventually prove to be that species. Cockerell, in his description of *vigilans*, erred in referring to the antennae as 12-segmented. They are 13-segmented, the last two, however, being less distinctly separated than the others.

Boulder, Colorado.

Known only from the type material.

4. ELASMOSOMA BAKERI Ashmead.

Elasmosoma bakeri ASHMEAD, Proc. Ent. Soc. Wash., vol. 3, 1895, p. 382.

Type.—In the United States National Museum.

As noted in the discussion of *vigilans*, I suspect that these two species are but opposite sexes of the same form. However, I hesitate to place *vigilans* in synonymy on the basis of so little material.

Fort Collins, Colorado; Mesilla, New Mexico; Falls Church, Virginia.

Besides the type specimens the National Collection contains one specimen labeled "Colo. 1228, Collection C. F. Baker;" and another labeled "Mesilla, N. Mex." I have also seen one specimen in the collection of Mr. Nathan Banks, at the Museum of Comparative Zoology, Cambridge, Massachusetts, which was taken by Mr. Banks at Falls Church, Virginia, May 30.

Subfamily MICROGASTERINAE.

Microgasteroidae FOERSTER, Verh. der naturh. Ver. preuss. Rheinl. und Westph., vol. 19, 1862, p. 244.

Microgasterides MARSHALL. Trans. London Ent. Soc., 1885, p. 151.

Microgasterinae CRESSON, Synopsis Hymen. N. Amer., 1887, pp. 55, 59.

Microgasteridae MARSHALL, in André, Species Hymen. Europe, vol. 4, 1888, p. 439.

Microgasterinae ASHMEAD, Proc. Ent. Soc. Wash., vol. 4, 1898, p. 165.—Proc. U. S. Nat. Mus., vol. 23, 1900, p. 130.—SZEPLIGETI, in Wytsman's Genera Insectorum, fasc. 22, 1904, p. 102.

Microgasterides LYLE, The Entomologist, vol. 49, 1916, p. 122.

Head transverse, the occiput usually immargined; clypeus not emarginate; palpi never so short as in the *Neoneurinae*, and always with more segments; antennae variable, but usually the number of segments is constant for each genus; eyes usually hairy; thorax stout; parapsidal grooves usually wanting; radius of fore wing wanting or abbreviated, never complete, the radial cell being always open and never very narrow; second cubital cell small, triangular, often confluent with third cubital cell; legs normal; the spurs of the posterior tibiae variable, very short to very long, but constant within the species; tarsal claws always distinct; abdomen sessile; ovipositor varying from sub-exserted to longer than the abdomen.

Most known species of *Microgasterinae* are properly placed in this subfamily without difficulty. However, species of the more or less aberrant genera, *Adelius*, *Mirax*, *Mesocoelus*, and *Oligoneurus*, none of which contains more than a few described forms, are sometimes erroneously referred to other groups. The most dependable characters for distinguishing the *Microgasterinae* are found in the wings—the more or less abbreviated radius, the rather full radial cell, and the small or wanting second cubital cell. These characters combined with those noted above will suffice to distinguish between members of this and allied groups.

Foerster originally included eight genera in what he called the Microgasteroidae. Six of these, *Adelius*, *Dirrhope*, *Mirax*, *Apanteles*, *Microplitis*, and *Microgaster*, are still retained in the subfamily as we limit it to-day. The other two genera, *Ecclites* and *Cardiochiles*, have been excluded because of the possession of a complete radial cell. As indicated above, *Ecclites* may be long to the *Blacinae; Cardiochiles* at present constitutes a separate subfamily.

Mesocoelus, *Mirax*, and *Adelius* contain very few species and none of these species is well represented in any known collection. *Apanteles*, *Microplitis*, and *Microgaster*, which together constitute the genus *Microgaster* as understood by Latreille, are very well represented in our fauna, and many of the species are exceedingly common and generally well known. These three genera make up a single natural group, differing markedly from the remaining genera of the subfamily and clearly merging into one another. The only justification for holding them distinct is the greater ease with which they can thus be handled by the systematist. Including more than two hundred described North American species, the group would be quite unwieldy; accordingly it seems desirable to recognize the artificial division into three genera. Within each of these three groups many species can be determined only with the greatest difficulty. Because of the considerable variation of specific characters it is always very desirable to have a series of several specimens. Odd collected specimens, particularly if they be males, must frequently be placed with some reservation; this applies especially to *Apanteles*.

The subfamily *Microgasterinae* contains many useful species. All that have been reared are parasitic on lepidopterous larvae, and many are exceedingly important agents in the control of injurious species. This is particularly true of numerous species of *Apanteles*, as was pointed out in the publication to which reference has been made above.

The genus *Apanteles* has been omitted from this paper, except for the description of four new species and brief synonymical notes. For a treatment of this group the reader is referred to my recent Revision of the North American Species of Apanteles.[9]

KEY OF THE GENERA OF MICROGASTERINAE.

1. Anterior wings with the median and submedian cells of equal length; both intercubital veins wanting, hence only one cubital cell present; antennae with 24, or more, segments ---------- 2.
   Anterior wings with the submedian cell distinctly longer than the median; at least the first intercubitus present; antennae always with less than 24 segments ---------- 3.
2. Antennae 28-segmented; mesoscutum normal, without a fovea on the disk. **Oligoneurus** Szepligeti.
   Antennae 24-segmented; mesoscutum with a rounded fovea on the disk. **Mesocoelus** Schulz.
3. First intercubitus long, attaining the stigma; radius not angled, obsolete except at extreme base ---------- 4.
   First intercubitus much shorter, not reaching the stigma; radius with two abscissae, the first making an almost right angle with the second, the second usually only indicated by a line of closely placed setae ---------- 5.
4. Antennae 14-segmented; stigma triangular, broad; radius arising from middle of stigma; second cubital cell not adjoining the first discoidal at base. **Mirax** Haliday.
   Antennae 20-segmented; stigma elongate-oval; radius arising far beyond the middle of stigma; second cubital cell adjoining the first discoidal at base ---------- **Adelius** Haliday.
5. Antennae 21-segmented; second abscissa of radius not entirely wanting; propodeum regularly areolated ---------- **Dirrhope** Foerster.
   Antennae 18-segmented; second abscissa of radius merely defined by a line of setae; propodeum not regularly aerolated, at most with a median areola ---------- 6.
6. Second cubital cell open behind, the second intercubitus entirely wanting. **Apanteles** Foerster.
   Second cubital cell not confluent with third, the second intercubitus present, though often more or less hyaline ---------- 7.

---

[9] Proc. U. S. Nat. Mus., vol. 58, 1920, pp. 483–576.

7. Clypeus separated from the face by a distinct raised line; inner spur of middle tibiae as long as middle metatarsus; inner spur of posterior tibiae longer, usually much longer, than half the posterior metatarsus; mesopleurae very rarely (*rubricoxus*) with a crenulate furrow; posterior coxae half as long as the thorax; metacarpus at least as long as the stigma. **Microgaster** Latreille.

Clypeus not separated from the face by a distinct raised line; inner spur of middle tibiae decidedly shorter than the middle metatarsus; inner spur of posterior tibiae very rarely as long as half the posterior metatarsus; mesopleurae (except in *carinatus* and *striatus*) with a distinct crenulate furrow; metacarpus rarely as long as stigma________ **Microplitis** Foerster.

Genus OLIGONEURUS Szepligeti.

Oligoneurus SZEPLIGETI, Termez. Fuzetek., vol. 25, 1902, p. 77; Genera Insectorum, fasc. 22, 1904, p. 103. *Genotype.—Oligoneurus concolor* Szepligeti. (Monobasic.)

The original description was as follows:

"Head transverse; eyes hairy; antennae 28-segmented; parapsidal grooves not distinct; propodeum indistinctly areolated, with a median carina; radial cell open, radius abbreviated; both intercubital veins wanting, hence only one cubital cell present; cubital and basal veins arising separately from the parastigma, the first discoidal cell sessile; second discoidal cell open; nervulus interstitial with basal vein; radial cell of hind wings wanting; legs rather stout; abdomen obovate; second abdominal segment the longest; the last ventral segment large; second suture indistinct."

This genus, based upon a single species from Brazil, has not yet been discovered in our North American fauna.

Genus MESOCOELUS Schulz.

Coelothorax ASHMEAD, Proc. U. S. Nat. Mus., vol. 4, 1898, p. 165; Trans. London Ent. Soc., 1900, p. 275. *Genotype.—Coelothorax laeviceps* Ashmead (Monobasic).

Mesocoelus SCHULZ (=*Coelothorax* ASHMEAD, preoccupied), Zool. Annal., vol. 4, 1911 (1909), p. 88.

Head transverse; occiput immargined; antennae 24-segmented; parapsidal furrows wanting; mesoscutum with a rounded fovea or depression; propodeum exareolated; mesopleurae with a furrow; median and submedian cells of equal length; the other cells entirely wanting; posterior legs long and stout, their coxae very long; abdomen sessile.

MESOCOELUS LAEVICEPS (Ashmead).

Coelothorax laeviceps ASHMEAD, Trans. London Ent. Soc., 1900, p 276.

Distribution.—St. Vincent.

Host.—Unknown.

The unique type is in the British Museum, and the genus is known to me only from the original description.

Genus MIRAX Haliday.

Mirax Haliday, Entom. Mag., vol. 1, 1833, p. 263; vol. 2, 1834, p. 230. *Genotype.—Mirax rufilabris* Haliday (Monobasic).
Centistidea Rohwer, Psyche, vol. 21, 1914, p. 81. *Genotype.—Centistidea ectoedemiae* Rohwer (Monobasic).

Allied to *Acoelius* Haliday, but at once distinguished by the 14-segmented antennae and the venational characters given in the key to genera, also by having a distinct embossed plate on the first abdominal tergite.

Occiput immargined; eyes indistinctly hairy; parapsidal grooves distinct anteriorly, entirely wanting posteriorly; radius obsolete, merely indicated by a line of closely-placed setae; first intercubitus attaining the stigma; first cubital cell often not completely separated from the first discoidal; spurs of posterior tibiae short; first and second abdominal tergites largely membranous, with slender embossed median plates.

KEY TO THE NORTH AMERICAN SPECIES OF MIRAX.

1. Vertex with a polished groove extending from the median ocellus to the occiput; basal segment of antennal flagellum not distinctly longer than the second — 2.
Vertex without such a groove from the median ocellus to the occiput; basal segment of antennal flagellum decidedly longer than the second — 3.
2. Head and thorax testaceous; abdomen testaceous beyond second tergite; second dorsal abdominal plate very finely striate laterally. 1. **pallida** Ashmead.
Thorax mostly brownish-black; abdomen blackish beyond second tergite; plate on the second tergite not striate — 2. **lithocolletidis** Ashmead.
3. Head, including antennae, entirely yellow; all legs and the two basal abdominal segments yellow — 3. **texana**, new species.
Head black — 4.
4. All coxae and femora strongly infuscated; tegulae and wing-bases brown. 4. **aspidiscae** Ashmead.
All coxae and femora yellow; tegulae and wing-bases pale yellow — 5
5. Propodeum highly polished, with several distinct longitudinal striae or rugae on either side of the median carina; length 2 mm. 5. **ectoedemiae** (Rohwer).
Propodeum without such striae or rugae; length hardly 1 mm. 6. **minuta** Ashmead.

1. MIRAX PALLIDA Ashmead.

Mirax pallida Ashmead, Psyche, vol. 6, 1893, p. 379.

Type.—In the United States National Museum.

Closely allied to *lithocolletidis*, differing only as noted in the key.

Jacksonville, Florida.

Known only from the unique type.

2. MIRAX LITHOCOLLETIDIS Ashmead.

Mirax lithocolletidis Ashmead, Psyche, vol. 6, 1893, p. 378.

Type.—In the United States National Museum.

Washington, District of Columbia; Jacksonville, Florida; Ithaca, New York.

The National Collection contains only the two specimens of the type series, the type from Washington, District of Columbia, and the allotype from Jacksonville, Florida. I have also seen one male and one female of this species in the Cornell University Collection, reared at Ithaca, New York, from *Lithocolletes aceriella* Clemens.

3. MIRAX TEXANA, new species.

Readily separated from *aspidiscae*, to which it is apparently closely allied, by the entirely yellow head, and the reticulated propodeum.

Male.—Length, 1.2 mm. Head a little broader than thorax, strongly receding behind the eyes, mostly smooth and shining; antennae about as long as the body, the first flagellar segment distinctly longer than the second; vertex without a median groove from the median ocellus to the occiput; parapsidal furrows deeply impressed anteriorly, wholly wanting behind; mesoscutum and scutellum mostly smooth, with only a few weak punctures; mesopleurae polished; propodeum reticulate with a median longitudinal carina, the interstices smooth and shining; stigma large, triangular, the first cubital and first discoidal cells broadly confluent; radius almost wholly obliterated; legs slender; posterior coxae short; spurs of posterior tibiae very short; abdomen about as long as thorax, depressed, slender at base, broadening suddenly at apex of first segment; the embossed plate on the first tergite very slender, and narrowing to a point at apex; second tergite almost entirely membraceous, the embossed plate being nearly reduced to a line on the anterior three-fourths; but broadening suddenly posteriorly so that it extends entirely across the tergite; entire abdomen smooth and shining. Head, including the antennae, wholly yellow; thorax brown, tegulae pale; wings hyaline, the veins and stigma pale yellow; legs, including all coxae, yellow; abdomen pale on basal half, blackish beyond.

Type locality.—Texas.

Type.—Cat. No. 24012, U.S.N.M.

Host.—" Tineid."

Described from a single male specimen, apparently from Texas, reared by C. H. T. Townsend, under his number 647–49, on June 14, 1895. Ashmead's manuscript name has been adopted.

4. MIRAX ASPIDISCAE Ashmead.

Mirax aspidiscae ASHMEAD, Psyche, vol. 6, 1893, p. 378, No. 1.
Mirax grapholithae ASHMEAD, Psyche, vol. 6, 1893, p. 378, No. 4.

Types.—In the United States National Museum.

Hosts.—*Aspidisca splendoriferella* Clemens; *Grapholitha prunivora* Walsh.

Only the type material is known; a study of this shows conclusively, I think, that *grapholithae* and *aspidiscae* are the same species.

5. MIRAX ECTOEDEMIAE (Rohwer).

Centistidea ectoedemiae ROHWER, Psyche, vol. 21, 1914, p. 81.

Type.—In the United States National Museum.

At once distinguished from *minuta* by the characters given in the table to species. Mr. Gahan had previously detected the synonymy of *Centistidea* with *Mirax*, and called my attention to this point. There can be no doubt whatever that *Centistidea* Rohwer is *Mirax* Haliday.

Ballston, Virginia.

Host.—*Ectoedemia castaneae* Busck.

Known only from the type specimens.

6. MIRAX MINUTA Ashmead.

Mirax minuta ASHMEAD, Psyche, vol. 6, 1893, p. 378.

Type.—In the United States National Museum.

Apparently the smallest of our described species.

Jacksonville, Florida.

The unique type is the only specimen known to me.

Genus ADELIUS Haliday.

Adelius HALIDAY, Entom. Mag., vol. 1, 1833, p. 262. *Genotype.*—*Adelius subfasciatus* Haliday (Monobasic).

Acaelius HALIDAY, Entom. Mag., vol. 2, 1834, p. 231. (Emendation.)

Pleiomerus (Wesmael) RATZEBURG, Ichn. v. Forstins., vol. 3, 1852, p. 65 *Genotype.*—*Adelius subfascinatus* Haliday (Monobasic). Isogenotypic with *Adelius* Haliday.

Acoelius HALIDAY Foerster, Verh. naturh. Ver. preuss Rheinl., vol 19, 1962, p. 244.—MARSHALL, Trans. Ent. Soc. London, 1885, p. 153. (Emendation.)

Anomopterus ROHWER, Psyche, vol. 21, 1914, p. 80. *Genotype.*—*Anomopterus fasciipennis* Rohwer (Monobasic).

Haliday, in 1834, specifically said that the name *Adelius*, published the preceding year, was due to an oversight, and published the correction, *Acaelius*. This name contained a typographical error, not repeated in the index of the volume, which was subsequently corrected by Foerster. However, it seems inadvisable to accept such emendations of generic names, though long in use; and in the present paper *Adelius* is held to be the valid name for the genus. That *Anomopterus* Rohwer is *Adelius* Haliday was brought to my attention by Mr. A. B. Gahan, who had earlier noted the identity of this genus.

Head almost subquadrate, the vertex quite long and flat; eyes shortly pilose; antennae 20-segmented; occiput margined; parapsidal grooves wanting; stigma elongate-oval, not angulated; radius arising far out on stigma, greatly abbreviated; first intercubitus attaining the stigma; second cubital cell bordering the first discoidal at base; posterior coxae small; spurs of posterior tibiae short; abdomen sessile, strongly depressed; the first tergite extending at least half the length of the abdomen.

KEY TO THE NORTH AMERICAN SPECIES OF ADELIUS.

1. Anterior wings with two broad fuscous bands, one just before and another just beyond the middle .... 2.
   Anterior wings, entirely hyaline; head, mesonotum and mesopleurae testaceous, the mesopectus black .... 1. **nigripectus**, new species.
2. Head entirely, and thorax except metanotum and propodeum, ferruginous; the fuscous bands on wings dark and well-marked; head and mesonotum granular .... 2. **fasciipennis** (Rohwer).
   Head above and behind, and the thorax entirely, piceous to black; the fuscous bands on wings weak and poorly defined; head and mesonotum punctate.
   3. **coloradensis**, new species.

1. ADELIUS NIGRIPECTUS, new series.

Somewhat resembles *fasciipennis*, but is at once separated by the clear hyaline wings, darker abdomen and receding temples.

Male.—Length 1.4 mm. Face twice as broad as long; vertex rather long, flat, indistinctly punctate, shining; temples receding sharply behind the eyes, and like the vertex, mostly smooth and shining; antennae nearly as long as the body; mesoscutum distinctly punctate anteriorly, impunctate and indistinctly alutaceous on posterior half; scutellum flat, impunctate; mesopleurae entirely polished with a longitudinal crenulate furrow below; propodeum impunctate and strongly shining, the dorsal aspect with a polished median longitudinal furrow bounded by sharp carinae, and with two distinct lateral carinae; a prominent transverse carina separating the dorsal and posterior aspects of propodeum; metapleurae polished; stigma large, evenly rounded behind, the radius originating far out and very short; the metacarpus less than one-third as long as the stigma measured along anterior margin; legs rather stout; posterior coxae about as long as propodeum, polished; posterior tibiae very slender at base, thickening strongly toward apex; spurs of posterior tibiae a little less than half as long as the metatarsus; abdomen very strongly depressed and entirely smooth and polished; first segment longer than the remainder of the abdomen. Head, except the stemmaticum, which is black, bright testaceous; antennae yellow on the basal third, fuscous beyond; mesoscutum, disk of scutellum and pleurae ferruginous; mesopectus, lateral faces of scutellum, metanotum and propodeum black; tegulae pale; wings clear byaline; legs including all coxae yellow, except the posterior femora above, and their tibiae and tarsi, which are very slightly infuscated.

Type locality.—Lafayette, Indiana.

Type.—Cat. No. 23981, U.S.N.M.

Host.—Larva of poplar leaf-miner.

Described from a single specimen reared September 24, 1915, at Lafayette, Indiana, in the Bureau of Entomology, under Cage No. C1269^b.

2. ADELIUS FASCIIPENNIS (Rohwer).

Anomopterus fasciipennis ROHWER, Psyche, vol. 21, 1914, p. 80.

Type.—In the United States National Museum.

A rather large species, mostly ferruginous, with conspicuously banded wings.

Falls Church, Virginia.

Host.—*Ectoedemia phloeaphaga* Busck.

Known only from the type series.

3. ADELIUS COLORADENSIS, new series.

Differs from *fasciipennis*, to which it is most closely allied, in its smaller size, much darker color, and in having the fuscous bands on the wings but poorly defined.

Male.—Length 1.3 mm. Face one and one half times as broad as long, very minutely punctate; vertex quite evenly rounded, and together with the temples and cheeks, very weakly punctate and mostly shining; antennae slender, nearly as long as the body, mesoscutum uniformly covered with closely placed separate punctures; scutellum small, flat, distinctly punctate; both mesoscutum and scutellum rather opaque; mesopleurae punctate and opaque anteriorly and below the longitudinal depression, quite polished above it; propodeum practically impunctate, strongly shining, the dorsal aspect with two indistinct median and two weak lateral carinae, the two former bounding a shallow polished median furrow; a distinct transverse carina separating the dorsal and posterior aspects of propodeum; stigma broad; the metacarpus exceedingly short, hardly one-fourth as long as the stigma; radius very short; legs somewhat thickened; the posterior coxae small, polished; spurs of posterior tibiae very short; abdomen depressed, a little narrower than thorax, smooth, subpolished; first segment about as long as the following combined. Blackish; face, clypeus, mouthparts, testaceous; antennae mostly brown; vertex and temples dark brown; stemmaticum black; thorax piceous to black; tegulae pale; wings hyaline, the anterior pair with two poorly defined pale fuscous transverse bands near the middle; legs including all coxae brown; abdomen brown.

Type locality.—Fort Collins, Colorado.

Type.—Cat. No. 23982, U.S.N.M.

Described from 1 specimen labeled "Ft. Collins, Col." and bearing Ashmead's manuscript name, *Acoelius coloradensis*.

Genus DIRRHOPE Foerster.

Dirrhope FOERSTER, Verh. naturh. Ver. preuss. Rheinl., vol. 8, 1851, p. 39; and vol. 19, 1862, p. 245.—MARSHALL, in André Species Hymen. Europe, vol. 4, 1888, p. 401. *Genotype.—Dirrhope rufa* Foerster (Monobasic).

Antennae 21-segmented, the scape long; propodeum areolated; radius of anterior wings with two abscissae, the first forming almost a right angle with the second, the second incomplete; second intercubitus wanting; posterior tibiae thickened, truncate at apex; abdomen with five segments visible above.

Apparently most like *Apanteles*, but at once separated by the greater number of antennal segments and the rather regularly areolated propodeum. No species of this genus are known to occur in our North American fauna.

Genus APANTELES Foerster.

Apanteles FOERSTER, Verh. naturh. Ver. preuss. Rheinl., vol. 19, 1862, p. 245. *Genotype.—Microgaster obscura* Nees (Monobasic).

Cotesia CAMERON, Mem. and Proc. Manchester Lit. and Phil. Soc., vol. 4 (ser. 4), 1891, p. 185, pl. 1, fig. 3 *Genotype.—Cotesia flavipes* Cameron (Monobasic)

Pseudapanteles ASHMEAD, Proc. Ent. Soc. Wash., vol. 4, 1898 (1897), p. 166 *Genotype—Pseudapanteles annulicornis Ashmead* (Viereck, 1911).

Protapanteles ASHMEAD, Proc. Ent. Soc Wash., vol. 4, 1898 (1897), p. 166. *Genotype—(Protapanteles ephyrae* Ashmead)=*Apanteles paleacritae* Riley (Viereck, 1914).

Parapanteles ASHMEAD, Proc. U. S. Nat. Mus., vol. 23, 1900, p. 131. *Genotype.—Apanteles aletiae* Riley (Monobasic).

Glyptapanteles ASHMEAD, Proc. U. S. Nat. Mus, vol. 28, 1904, p. 117. *Genotype.—Glyptapanteles manilae* Ashmead (Monobasic).

Cryptapanteles VIERECK, Proc. Ent. Soc. Wash, vol. 11, 1909, p. 209 (=*Apanteles* Ashmead, Proc. Ent. Soc. Wash., vol. 4, 1898 (1897), p. 166, not Foerster). *Genotype.*– (*Apanteles emarginatus* Riley)=*Apanteles scitulus* Riley (Monobasic).

Urogaster ASHMEAD, Proc. Ent. Soc. Wash., vol. 4, 1898 (1897), p. 166. *Genotype.—Urogaster vulgaris* Ashmead (Viereck, 1914).

Apanteles (*Dolichogenidea*) VIERECK, Proc. U. S. Nat. Mus., vol. 40, 1911, p. 173. *Genotype.—Apanteles* (*Dolichogenidea*) *banksi* Viereck (Monobasic).

Stenopleura VIERECK, Proc. U. S. Nat. Mus., vol. 40, 1911, p. 187. *Genotype.—Apanteles sesamiae* Cameron (Monobasic).

Allapanteles BRETHÉS, Anales Mus. Nac. Buenos Aires, vol. 27, 1915, p 404. *Genotype.—Allapanteles cecidiptae* Brethés (Monobasic).

Cotesia Cameron and *Allapanteles* Brethés were not included in the synonymy of *Apanteles* in my recent revision of this genus. However, there can be no doubt that they belong here. The description of *Cotesia* is obviously that of an *Apanteles* except for the statement that the antennae are 17-segmented. This was undoubtedly the result of a miscount, for the figure shows 18 distinct segments. The description of *Allapanteles cecidiptae* Brethés, upon which the genus *Allapanteles* was based, likewise agrees absolutely with *Apanteles* Foerster.

For a key to the North American species of this genus, see Proceeding of the United States Natural Museum.[10] At the time that paper was prepared I had not seen the types of Cresson's four West Indian specimens *hyalinus*, *pinos*, *flaviventris*, and *marginatus*, and I accordingly placed these in my key on the basis of the original description. Recently I have examined this type material at the Philadelphia Academy of Sciences, and I find *hyalinus*, *pinos*, and *flaviventris* to fit into the places assigned them in my table to species. But *marginiventris* runs at once to *grenadensis* Ashmead, and after studying the seven specimens constituting the type series of the former, I have definitely concluded that the two names are synonymous; *grenadensis* Ashmead, then, must be suppressed.

APANTELES MARGINIVENTRIS (Cresson).

Microgaster marginiventris CRESSON, Proc. Ent. Soc. Philadelphia, vol. 4, 1865, p. 67.

Apanteles marginiventris Cresson, ASHMEAD, Trans. Ent. Soc. London, 1900, p. 277.

Apanteles grenadensis ASHMEAD, Trans. Ent. Soc. London, 1900, pp. 277, 278.

Apanteles (*Protapanteles*) *harnedi* VIERECK, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 580.

Type.—In the Philadelphia Academy of Sciences. Cotypes of *grenadensis* and type of *harnedi* in the United States National Museum; other cotypes of *grenadensis* are in the British Museum.

This species is widely distributed through the Southern States and the West Indies.

APANTELES CAUDATUS, new species.

Runs to category 69, in my key to species referred to above. and is very similar to *cinctiformis* Viereck, from which it is at once separated by the darker abdomen, the longer, curved, black ovipositor sheaths of the female, and the enormous claspers of the male.

Female.—Length, 3.5 mm. Face broader than long, sparsely, shallowly punctate and shining; vertex, temples, and cheeks weakly punctate, strongly shining; antennae slightly shorter than the body; mesoscutum covered with minute shallow punctures, shining, almost polished posteriorly; scutellum practically impunctate and polished; mesopleurae weakly punctate anteriorly, polished, and shallowly foveate posteriorly; propodeum closely punctate, with a median longitudinal carina; stigma large, very slightly shorter than the metacarpus; radius and first intercubitus subequal in length and meeting in a rather strong angle; posterior coxae smooth and shining,

---

[10] Vol. 58, 1920, pp. 487–502.

with only a few weak punctures; inner spur of posterior tibiae half as long as the metatarsus; abdomen about as long as thorax and somewhat compressed; first dorsal abdominal plate slender, distinctly a little narrower at apex than at base, smooth and polished down the middle, punctate or weakly striate laterally; second dorsal plate subtriangular, as broad at base as long down the middle, defined laterally by oblique grooves; like the first plate, the second is mostly smooth and polished, being only slightly punctate or striate at the sides; remainder of abdomen smooth and polished; hypopygium large, but not surpassing the apex of the last dorsal abdominal segment; ovipositor sheaths at least two-thirds as long as the abdomen, broad, of nearly uniform width throughout, and strongly curved downward; the ovipositor likewise strongly curved on its apical half. Black; mandibles more or less reddish, the palpi pale; antennae black, except the pedicel, which is dark brown; tegulae pale yellow; wing-bases brown; wings hyaline or subhyaline, the costal margin and veins largely yellowish; stigma pale brown; legs entirely testaceous, except base of the posterior coxae, which is black, and the apical segments of posterior tarsi, which are slightly brownish; dorsum of abdomen black, except the broad membranous margins along the two basal plates, which are brownish-testaceous, and more or less of the sides and the apical margin of the third tergite, which are brownish; sides of venter of abdomen testaceous except at apex; ventral keel and ovipositor sheaths black.

Male.—Essentially as in the female; the enormous, broad claspers of the genitalia protruding more than half the length of the abdomen will readily distinguish this species from the male of any other *Apanteles* known to me.

Type.—Cat. No. 568. Cornell University Collection.

Paratypes.—Cat. No. 24330 U.S.N.M.

Type locality.—Carbonate, British Columbia.

Other localities.—Cheyenne, Wyoming; Yellowstone Lake, Montana; and Mica, Washington.

Described from the following material: One female and two male specimens collected by Dr. J. C. Bradley, at Carbonate, British Columbia, July 7–12, 1908, altitude 2,600 feet; one male specimen collected by Fanny T. Hartman at Cheyenne, Wyoming, June–August, 1907; three females collected by A. L. Melander at Mica, Washington, July 14, 1916; and one male taken by Doctor Melander at Yellowstone Lake, Montana. The female and two of the males from British Columbia and the male from Wyoming are in the Cornell University Collection; one male from British Columbia and a female from Mica, Washington, are in the United States National Museum; the remaining three specimens are in the collection of Dr. C. T. Brues, of Harvard University.

APANTELES ALYPIAE, new species.

Runs to category 119 in my key, and falls between *depressus* and *pyralidis.* The antennae are longer than in those species, with the first four flagellar segments subequal; it differs further in having no median carina on the propodeum.

Female.—Length, 2 mm. Face broader than long, indistinctly punctate and strongly shining; vertex polished; temples somewhat punctate behind; antennae as long as the body, the first four flagellar segments subequal, the five apical segments much shortened; mesoscutum entirely shallowly punctate, shining; scutellar disk with very few indistinct punctures, subpolished; mesopleurae highly polished; propodeum wholly rugulose, with a more or less distinct longitudinal impression medially, and without a median carina; fore wing with radius and first intercubitus subequal in length; posterior coxae very smooth, subpolished; spurs of posterior tibiae subequal and nearly half as long as the metatarsus; abdomen ovate, the first dorsal abdominal plate with base and apex of apparently equal breadth, the sides bulging somewhat just beyond the middle, the basal half of the plate polished, the apical half rugulose; dorsal plate of the second segment transverse, the sides oblique on the basal half, parallel on posterior half, entirely finely rugulose; posterior margin of second tergite straight, or curving slightly posteriorly at the sides; third abdominal tergite much longer than the second, and like the following, smooth and polished; ovipositor sheaths subexserted. Black; antennae black, tegulae and wing-bases brownish-black; wings hyaline; venation pale brown; fore and middle legs wholly yellow; posterior coxae black except at extreme apex; remainder of posterior legs yellow, except a very small spot at extreme apex of hind femora, the apical third of hind tibiae and the hind tarsi, which are fuscous; abdomen black.

Male.—Essentially as in the female.

Type locality.—Wallingford, Connecticut.

Type.—Cat. No. 24025, U.S.N.M.

Host.—*Alypia octomaculata* Fabricius.

Described from eight female and five male specimens reared in the Bureau of Entomology, under Quaintance No. 16569, June 2–4, 1919, by B. A. Porter. Two other specimens of the same series are in the Cornell University Collection.

APANTELES OLENIDIS, new species.

Very similar to *fiskei* Viereck, from which it differs in the black tegulae, the more shining, more weakly punctate mesonotum, the more shining hind coxae, and the somewhat stouter abdomen. Runs to *argynnidis* in my key, but has mesoscutum and scutellum much more smooth and shining. This may be a Western race of *fiskei.*

Female.—Length 3.2 mm. Head transverse; antennae nearly as long as body; vertex and temples smooth and shining; thorax stout; mesoscutum very strongly shining; the punctures very small, shallow, well separated; scutellum large, slightly convex, subpolished, with only a few indistinct punctures; propodeum finely rugose; transverse carinae near base of propodeum setting off two transverse areas that are smooth and shining within; mesopleurae polished, only punctured anteriorly and below; fore wing with stigma twice as long as broad; metacarpus a little longer than stigma; radius somewhat longer than transverse cubitus; posterior coxae very smooth and shining; posterior femora rather stout; inner spur of posterior tibiae slightly more than half as long as posterior metatarsus; abdomen rather stout; first abdominal tergite broadening posteriorly, much broader at apex than at base; second tergite rectangular; first and second tergites, and the third except in the posterior lateral angles, very finely closely rugulose, more finely so than in *fiskei*; remainder of dorsum of abdomen smooth and polished; hypopygium stout, but hardly exceeding apex of abdomen. Black; antennae and tegulae black; fore coxae somewhat blackish at base; posterior coxae black; wings hyaline; stigma dark brown; abdomen black, testaceous at base beneath.

Male.—Essentially as in female.

Type.—Cat. No. 24960, U.S.N.M.

Type locality.—Vernon, British Columbia.

Host.—*Olene vagans* Barnes and McDunnough.

Described from 14 female and 9 male specimens labeled as bred from *Olene vagans* by E. P. Venable. Six of the paratype specimens are in the Canadian National Collection at Ottawa; the remainder of the type material is in the United States National Museum in Washington.

APANTELES MIMORISTAE, new species.

Very similar to *aristoteliae*, agreeing in general appearance, in color, and in the length of the ovipositor. It differs from that species, however, in the first abdominal tergite, being distinctly narrower at apex than at base, in the much smoother second abdominal tergite, and in the whiter wings, with the stigma brown only in the margins.

Female.—Length 2.5 mm. Head transverse; face closely punctate; antennae shorter than the body; vertex closely punctate and opaque; mesoscutum very closely punctate, dull; disk of scutellum flat, punctate and opaque; mesopleurae opaque, mostly punctate; propodeum rugulose, with a rather well-defined median areola, which is smooth and shining within; costulae indistinct; inner spur of posterior tibiae more than half as long as the metatarsus; first abdominal tergite narrowing decidedly on apical third, distinctly narrower at apex than at base, closely finely ruguloso-punctate, with a longitudinal fovea medially on the posterior half of segment; second abdominal tergite transverse, short, broader at apex than at base, more than four times as broad at apex as long down the middle, and largely smooth and shining; remainder of dorsum of abdomen smooth and polished; hypopygium large, slightly projecting; ovipositor sheaths nearly as long as the abdomen. Black; antennae, tegulae, all coxae, most of the middle femora, and hind femora entirely, black; apex of posterior tibiae, and the posterior tarsi, except at base of basal segment, blackish; wings whitish-hyaline; veins hyaline; stigma brown only in the margins; abdomen black.

Male.—Essentially as in the female, differing, however, in the longer antennae, and the less distinct median fovea on first abdominal tergite.

Type.—Cat. No. 24961, U.S.N.M.

Type locality.—Uvalde, Texas.

Hosts.—*Melitara junctolineella* Hulst, and *Mimorista flavidissimalis* Grote.

Described from four females and one male reared by J. C. Hamlin, June, 1921.

Genus MICROGASTER Latreille.

Microgaster Latreille, Hist. Nat. Crust. Ins., vol. 13, 1805, p. 189. *Genotype.*—*Ichneumon deprimator* Fabricius (Latreille, 1810).

Hygroplitis Thomson, Opusc. Entom., pt. 20, 1895, pp. 2238, 2244. *Genotype.*—*Microgaster russata* Haliday (Viereck, 1914).

Hypomicrogaster Ashmead, Proc. Ent. Soc. Wash., vol. 4, 1898 (1897), p. 166; Smith's Insects N. J., 1900, p. 594. *Genotype.*—*Microgaster zonaria* Say (Monobasic).

Protomicroplitis Ashmead, Proc. Ent. Soc. Wash., vol. 4, 1898 (1897), p. 167. *Genotype.*—*Protomicroplitis garmani* Ashmead (Ashmead, 1900).

Diolcogaster Ashmead, Smith's Ins. New Jersey (Mar.) 1900, p. 594; Proc. U. S. Nat. Mus., vol. 23, Oct., 1900, p. 132. *Genotype.*—*Microgaster brevicauda* Provancher (Monobasic).

Head transverse; clypeus separated from face by a raised line; eyes hairy; antennæ 18-segmented; mesoscutum without parapsidal furrows; mesopleurae very rarely with a crenulate furrow; stigma never longer than metacarpus; second intercubitus present, the second cubital cell complete; posterior coxae large, half as long as the thorax; spurs of middle tibiae as long as the middle metatarsus; spurs of posterior tibiae more, usually much more, than half as long as the posterior metatarsus; abdomen sessile.

This genus and the following are very closely allied, and while most species are readily placed a few are so close as to be separable only with great difficulty. However, the combination of characters given in the key to genera should suffice to distinguish between species of *Microgaster* and *Microplitis*.

Apparently most of the species of *Microgaster* are solitary parasites, always of lepidopterous larvae. The cocoons are of white silk and are never surrounded by a mass of fluffy loose silk, as is often true in the genus *Apanteles.* Although a considerable amount of material is found in most collections, few of our known species are particularly common, *Microgaster gelechiae* Riley being perhaps the best known of these.

KEY TO THE NORTH AMERICAN SPECIES OF MICROGASTER.

1. Propodeum without a distinct median longitudinal carina, very weakly roughened and usually provided with a more or less distinct areola; second abdominal tergite much shorter than the third, transverse, defined laterally by oblique grooves, and mostly smooth and shining; ovipositor sheaths more than half as long as the abdomen; second cubital cell minute, often indistinct---------- 2.

Propodeum always with a prominent median carina and usually coarsely rugose---------- 3.

2. Posterior coxae, femora and tibiae wholly testaceous; second and third abdominal tergites testaceous---------- 1. **zonaria** Say.

Posterior coxae deep black on basal half; posterior tibiae with the apical third blackish; second abdominal tergite black.
2. **ecdytolophae,** new species.

3. First dorsal abdominal plate long and narrow, at least three times as long as broad at apex, never broader at apex than at base; the second abdominal tergite mostly smooth and polished---------- 4.

First dorsal abdominal plate never so long and slender; second abdominal tergite usually rugose---------- 9.

4. Second dorsal abdominal plate deeply and angularly emarginate anteriorly to receive the plate of the first tergite, and without longitudinal impressed lines medially; the first plate narrowest in the middle, the sides curving inward. Length 4 mm. or more---------- 5.

Second dorsal abdominal plate not emarginate anteriorly, and provided with two longitudinal impressed lines medially; first dorsal abdominal plate narrowest at apex. Length not over 2.5 mm---------- 7.

5. Wings hyaline; all coxae and femora black; abdomen mostly black.
3. **garmani** (Ashmead).

Wings maculated; all coxae and femora reddish-testaceous; abdomen mostly red---------- 6.

6. Head and thorax, except propodeum, testaceous---------- 4. **mediata** Cresson.

Head and thorax entirely black---------- 5. **calliptera** Say.

7. All coxae entirely pale yellow; mesoscutum and scutellum with distinct separate punctures---------- 6. **iridescens** Cresson.

Posterior coxae black; mesoscutum and scutellum coarsely confluently punctate---------- 8.

8. Posterior femora black; second cubital cell exceedingly minute, indistinct; median area on second abdominal tergite minutely shagreened.
7. **xanthaspis** (Ashmead).

Posterior femora blackish only on apical third or half; second cubital cell normal, the second intercubitus distinct; median area on second abdominal tergite polished---------- 8. **bakeri,** new species.

9. Second abdominal tergite provided with two longitudinal furrows medially; scutellum always sculptured, ovipositor sheaths hardly protruding__10.
Second abdominal tergite uniformly rugose, without such longitudinal furrows medially; scutellum smooth, usually polished; ovipositor sheaths usually projecting at least half the length of the abdomen__________13.

10. Propodeum and the two basal abdominal tergites smooth and shining, with only a few weak scattered punctures; third tergite wholly smooth and polished; mesoscutum and scutellum with distinct separate punctures, and shining__________ 9. **schizurae**, new species.
Propodeum and the two basal abdominal tergites, with usually part of the third, rugulose or closely punctate; mesoscutum and scutellum usually confluently punctate and opaque__________11.

11. Part of the second abdominal tergite and the following tergites almost entirely, reddish-testaceous; stigma yellow, somewhat paler at base; all coxae wholly testaceous__________ 10. **auripes** Provancher.
Dorsum of abdomen mostly black; if partly testaceous posterior coxae are black on basal half__________ 12.

12. Posterior coxae wholly reddish-testaceous; longitudinal grooves on second abdominal tergite parallel and very close together, inclosing an exceedingly slender embossed area, which is scarcely more than a carina; dorsum of abdomen black__________ 11. **brevicauda** Provancher.
Posterior coxae black on basal half; the longitudinal grooves on second tergite widely separated at base of tergite, converging posteriorly.
12. **facetosa** Weed.

13. Propodeum horizontal, not declivous; mesopleurae with a very narrow, finely crenulate longitudinal furrow; apical segment of tarsi very large; inner spur of middle tibiae hardly as long as middle metatarsus; all coxae reddish-testaceous; length about 5 mm______ 13. **rubricoxa** Provancher.
Propodeum always strongly declivous; mesopleurae never with a crenulate furrow; inner spur of middle tibiae distinctly at least as long as middle metatarsus__________ 14.

14. The fore and middle coxae, and at least the apex of posterior coxae, testaceus; or, if all coxae are brownish-black (rarely, in *brittoni* Viereck), then the venter of abdomen and most of the dorsum beyond second tergite are bright testaceous; tegulae nearly always yellow__ 15.
All coxae black, rarely apex of all coxae testaceous; dorsum of abdomen, and usually the venter, black; tegulae usually back__________ 19.

15. Face with distinct, separate, large punctures, not rugulose; third abdominal tergite wholly smooth; posterior femora short, hardly longer than hind coxae; all coxae and most of the dorsum of abdomen beyond second tergite, testaceous; ovipositor sheaths projecting much less than half the length of the abdomen__________ 14. **melligaster** Provancher.
Face finely ruguloso-punctate, the punctures not separated; third abdominal tergite usually distinctly somewhat punctate or striate on basal half__________ 16.

16. Anterior wing with the third cubital cell and the region behind it subhyaline or slightly fuliginous; usually part of the dorsum of abdomen and the entire venter testaceous__________ 18.
Anterior wing entirely clear hyaline; dorsum of abdomen and apical third of venter black__________ 17.

17. Stigma not distinctly twice as long (measured along the anterior margin) as its greatest breadth, and with a conspicuous pale spot at base; posterior coxae wholly testaceous; ovipositor sheaths broadest near the middle, narrowing somewhat toward the apex from this point.
15. **harnedi**, new species.

Stigma decidedly more than twice as long as its greatest breadth, and without a noticeable pale spot at base; ovipositor sheaths broadening steadily posteriorly, broadest at apex____ 16. **pantographae**, new species.

18. Posterior coxae wholly black, and with a distinct flattened punctate area on outer upper edge at base; scutellum unusually small, flat; apex of posterior tibiae and the posterior tarsi blackish; ovipositor sheaths slender and hardly half as long as the abdomen____________ 17. **brittoni** Viereck.

Posterior coxae usually pale on apical half and without such a distinct flattened area at base; posterior femora, tibiae and tarsi wholly testaceous; scutellum large, flat; ovipositor sheaths broad and two-thirds as long as the abdomen________________________________ 18. **gelechiae** Riley.

19. Ovipositor sheaths hardly one-fourth as long as the abdomen and very slender; mesoscutum entirely, and the scutellum with distinct scattered shallow punctures_____________________ 19. **swammerdamiae**, new species.

Ovipositor sheaths at least half as long as the abdomen; mesoscutum posteriorly, and scutellum impunctate and polished_____________ 20.

20. Third abdominal tergite smooth; first tergite usually shorter than broad at apex; also usually shorter than the dorsum of the abdomen beyond second tergite; coxae always wholly black___________________________ 21.

Third abdominal tergite somewhat roughened, first tergite usually longer than broad at apex, and usually longer than dorsum of abdomen beyond second tergite: occasionally all coxae are pale at apex______________ 23.

21. Venter of abdomen mostly yellowish; stigma pale brown without a paler spot at base; ovipositor sheaths distinctly two-third as long as the abdomen_______________________________________ 20. **carinata** Packard.

Venter of abdomen black; stigma dark brown with a paler spot at base; ovipositor sheaths not more than half as long as the abdomen______ 22.

22. Face shallowly weakly punctate and strongly shining; clypeus almost impunctate; posterior tibiae and tarsi pale testaceous; posterior margin of second tergite straight_____________________ 21. **comptanae** Viereck.

Face and clypeus finely ruguloso-punctate and opaque; posterior tibiae at apex and the posterior tarsi blackish; posterior margin of second tergite curving forward at the sides______________ 22. **canadensis**, new species.

23. All femora mostly black or blackish___________ 23. **femoralis**, new species.

All femora testaceous____ 24.

24. Face very weakly punctate and shining, and without a distinct median carina extending from antennal fossae nearly half way to the clypeus, at most with a small polished tubercle below antennal fossae; clypeus almost impunctate______________________________ 24. **phthorimaeae**, new species.

Face and clyeus very finely rugulose, with a prominent median polished carina extending from antennal fossae nearly halfway to the clypeus_ 25.

25. Extreme apex of all coxae, and the trochanters pale; venter of abdomen yellowish on basal half; stigma unicolorous; fore wing without a fuscous spot across radius just below stigma______________ 25. **epagoges** Gahan.

Coxae entirely, and the basal segment of trochanters, black; venter of abdomen black; stigma with a distinct pale spot at base; fore wing with a conspicuous fuscous spot across radius just below stigma.
26. **congregatiformis** Viereck.

1. MICROGASTER ZONARIA Say.

Microgaster zonaria SAY, Boston Journ. Nat. Hist., vol. 1, 1836, p. 263.

Hypomicrogaster zonaria Say, ASHMEAD, in Smith's Insects, N. J., 1900, p. 594.

Protapanteles recurvariae ASHMEAD, Journ. N. Y. Ent. Soc., vol. 11, 1903, p. 144.

Microgaster recurvariae Ashmead, MUESEBECK, Proc. U. S. Nat. Mus., vol. 58, 1920, p. 570.

Type.—Say's type has been lost, but the United States National Museum contains authentic material determined by Ashmead. The types of *recurvariae* are also in the National Collection.

Indiana; District of Columbia; Illinois; Ohio; New Jersey; Colorado.

Hosts.—*Recurvaria piceaella* Kearfott and *R. thujaella* Kearfott (Ashmead).

There can be no doubt that *recurvariae* Ashmead is *zonaria* Say. The species is readily distinguished by the characters given in the key.

The National Collection contains, in addition to the types of *recurvariae*, eight specimens from the Ashmead Collection, taken at Washington, District of Columbia; four from Algonquin, Illinois; one from Ohio and one labeled "Colo. 2037, Collection C. F. Baker." I have also seen the following additional material: one specimen from Chicago, Illinois, in Doctor Brues's collection at Harvard University; two, from Flatbush, New York, belonging to the American Museum of Natural History; and three specimens taken at Ithaca, New York, and three at Fairhaven, New York, which are in the collection of Cornell University.

2. MICROGASTER ECDYTOLOPHAE, new species.

Very similar to *zonaria*, differing from that species in its somewhat larger size, in the posterior coxae being black on the basal half, in the black second tergite, and in the longer ovipositor. It has the habitus of *Apanteles* and is easily misplaced in that genus because of the indistinctness of the second cubital cell.

Female.—Length 3 mm. Face a little broader than long, with distinct separate punctures; vertex mostly smooth and shining; temples weakly punctate and rather opaque; antennae about as long as the body; mesoscutum evenly rounded and rather evenly covered with distinct shallow punctures, shining; scutellum flat, impunctate, highly polished, with a poorly defined smooth impression posteriorly; propodeum punctate or very weakly rugulose, without a median carina, and with a suggestion of a median areola outlined by faint carinae; metapleurae almost entirely smooth and highly polished; stigma rather large, somewhat shorter than metacarpus; radius arising considerably beyond the middle of stigma, perpendicular to the anterior margin of wing and about as long as the first intercubitus; second cubital cell exceedingly minute, the second intercubitus very short and indistinct, and connecting cubitus and first intercubitus rather than cubitus and the first abscissa of radius; posterior coxae large, at least half as long as thorax, closely punctate on the outer face, and with a very long, narrow, flattened, very finely aciculate area on the outer upper edge; inner spur of middle tibiae a little longer than middle metatarsus; inner spur of posterior tibiae at least two-thirds as long as posterior metatarsus; abdomen nearly as long as thorax but much more slender; first dorsal abdominal plate large, covering more than a third of the abdomen, broader at apex than at base, a little longer than its greatest breadth, and rather evenly covered with distinct separate punctures, strongly shining; second tergite short and broad, much shorter than the third, and nearly four times as broad as long down the middle, where it is longer than at the sides, the posterior margin being decidedly curved; practically the entire second plate, like the remainder of the abdomen, smooth and polished; hypopygium prominent but not surpassing the apex of the last dorsal segment; ovipositor sheaths nearly as long as the abdomen. Black; labrum, mandibles, and palpi yellowish; scape, except a narrow black stripe on the outer side, and the apex, bright yellow; remainder of the antennae black; tegulae and wing-bases pale yellow; wings very clear hyaline; costa yellowish; other veins largely, and the stigma, brown; anterior and middle legs entirely pale yellow, the tarsi whitish, the pulvilli brown; posterior coxae black on the basal half or two-thirds, yellow beyond; posterior trochanters pale; posterior femora testaceous except at extreme tip, their tibiae blackish on the apical third, their tarsi brown except at extreme base; abdomen black; the third tergite bright testaceous except medially and along posterior margin; venter of abdomen entirely testaceous; ovipositor sheaths black.

Male.—Like the female, except that the abdomen is more slender, the first tergite being nearly parallel-sided, and the second not so broad as in the female; the third tergite is almost entirely black.

Cocoons.—White, solitary, with a little loose silk.

Type locality.—Falls Church, Virginia.

Allotype locality.—Bentonville, Arkansas.

Type.—Cat. No. 23987, U.S.N.M.

Hosts.—*Ecdytolopha insiticiana* Zeller on *Robinia*; *Canarsia hammondi* Riley; *Gelechia*, species (?).

Described from five females and two males bearing the following data: Type, reared from *Ecdytolopha insiticiana* at Falls Church, Virginia, July 25, 1914, by C. Heinrich, under Hopkins U. S. No. 12103 L-2; *allotype*—Bentonville, Arkansas, Aug. 1, 1919; *paratypes*—two reared from *Canarsia hammondi* Riley July 23, 1919, by D. Isely, in the Bureau of Entomology, under Quaintance No. 16471; one labeled "Parasite on Gelechia sp.?"; and one labeled "Cana. 2156 Collection

C. F. Baker." There are two additional specimens in the National Collection bearing the label, "Victoria, Tex., Hunter No. 2391, J. D. Mitchell, Collector." I have also seen seven specimens in the Cornell University Collection: three from Freeville, New York; one from Ithaca, New York; one from Truro, Nova Scotia, collected by Dr. R. Matheson; and two from Mount Whiteface, New York, 2,000–4,000 feet, collected August 22–24, 1916.

3. MICROGASTER GARMANI (Ashmead).

Protomicroplitis garmani ASHMEAD, Proc. U. S. Nat. Mus., vol. 23, 1900, p. 132 (without specific description).

A very distinct species, easily placed by the characters given in the foregoing key.

Female.—Length 4 mm. Face and clypeus confluently punctate, shining, a prominent polished median carina extending half way from antennal fossae to the clypeus; vertex very shallowly minutely punctate and shining; the temples, and more particularly the cheeks, coarsely punctate; antennae a little longer than the body; mesoscutum and scutellum covered with closely placed but distinct, deep punctures, shining; mesopleurae coarsely punctate except for a smooth and highly polished subquadrate area on the upper middle region; below and just behind the middle there is a shallow, noncrenulate depression; propodeum coarsely rugose, with a prominent median longitudinal carina; stigma moderate, about as long as the metacarpus; radius arising a little beyond middle of stigma, curved and directed outward, nearly twice as long as the first intercubitus; posterior coxae large, more than half as long as the thorax, entirely coarsely punctate; inner spur of middle tibiae as long as middle metatarsus; inner spur of hind tibiae two-thirds as long as hind metatarsus; abdomen slender, compressed, nearly as long as thorax; first dorsal abdominal plate long and slender, more than three times as long as broad, the sides nearly parallel, base and apex of equal breadth; a deep median longitudinal channel extending nearly to the apex of the first plate, the basal half of the plate polished, the apical half weakly roughened and shining; second dorsal abdominal plate smooth and polished, medially a little shorter than the third tergite, strongly angularly emarginate anteriorly, the sides extending forward acutely more than one-third the length of the basal plate; remainder of the abdomen smooth and shining; ovipositor sheaths slender, less than half as long as the abdomen. Black; labrum and mandibles except at base and apex, reddish-testaceous; palpi pale yellow; antennae brownish-black; tegulae testaceous; wing-bases brown; wings hyaline, subhyaline at apex; veins and stigma brown; all coxae black; remainder of fore and middle legs testaceous, except the trochanters and the femora basally, which are brownish; posterior trochanters and femora black; apical half of posterior tibiae and the posterior tarsi strongly infuscated; abdomen blackish above, the broad membranous margins along the plate of the first segment pale yellow; venter of abdomen piceous, yellow at base.

Male.—Essentially as in the female.

Type locality.—Champaign, Illinois.

Type.—Cat. No. 23986, U.S.N.M.

Described from four specimens collected at Champaign, Illinois, and bearing Ashmead's type labels. The National Collection contains the following additional material: two specimens from Lexington, Kentucky; three specimens collected by G. R. Pilate at Opelousas, Louisiana; ten from the C. F. Baker Collection, all taken in Louisiana; one collected by R. A. Cushman at Vienna, Virginia, June 4, 1911; and one taken in the District of Columbia June 2, 1884. I have also seen one specimen, taken by W. M. Mann, at Wathena, Kansas, in the collection of Dr. C. T. Brues at Harvard University; and one collected at Flatbush, New York, by J. L. Zabriskie, which is in the collection of the American Museum of Natural History.

As originally proposed by Ashmead this species was named *germani*, but as this is manifestly a typographical error, as the species was intended to be named for Professor Garman, I have considered it desirable and permissible to use the above spelling.

4. MICROGASTER MEDIATA Cresson.

Microgaster mediatus CRESSON, Proc. Ent. Soc. Philad., vol. 4, 1865, p. 66.
Protomicroplitis mediatus Cresson, ASHMEAD, Trans. Lond. Ent. Soc., 1900, p. 292.

Type.—In the Academy of Sciences at Philadelphia.

This species is readily distinguished from *calliptera*, to which it is most closely allied, by the reddish-testaceous head and thorax, only the metapleurae and propodeum being black; also by the hyaline nonmaculated wings.

Cuba, Mexico.

In addition to the type the Philadelphia collection contains five other specimens from Cuba and one from Mexico. No other material of this species is known to me.

5. MICROGASTER CALLIPTERA Say.

Microgaster calliptera SAY, Boston Journ. Nat. Hist., vol. 1, 1836, p. 264.
Microgaster maculipennis CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 183.

Type.—The type of *calliptera* has been lost, but the species is sufficiently well characterized to make its identity certain. The type of *maculipennis* is in the Philadelphia Academy of Sciences.

Texas; Georgia; Kansas; Louisiana; Colorado; North Carolina.

Hosts.—*Perigea sutor* Guenée; *Platysenta videns* Guenée.

Cocoons.— Large, white, with a little loose silk.

I have seen the following material of this species: type of *maculipennis*, from Texas, paratype and six other specimens from Georgia, in the Philadelphia Academy of Sciences; three specimens of the type series of *maculipennis*, from Texas, in the United States National Museum. The National Collection contains in addition, one specimen from Lawrence, Kansas, collected June 20, 1895, by Hugo Kahl; one from Cypress Mills, Texas; one from Louisiana and one from Colorado, from the C. F. Baker Collection; one reared at Raleigh, North Carolina, August 23, 1919, by C. S. Brimley, from *Perigea sutor* Guenee; five specimens, without locality label, reared from *Platysenta videns* Guenee; two specimens labeled Victoria, Texas, October 21, 1914, J. D. Mitchell, collector, and bearing Hunter No. 3478; one from the same locality by the same collector, dated April 14, 1915, bearing Hunter No. 3579; and one specimen taken at Victoria, Texas, August 3, 1910, on *Cassia*, species, by J. D. Mitchell.

6. MICROGASTER IRIDESCENS Cresson.

Microgaster iridescens CRESSON, Proc. Ent. Soc. Philad., vol. 4, 1865, p. 68.
Urogaster iridescens Cresson, ASHMEAD, Trans. Lond. Ent. Soc., 1900, pp. 277, 278.

Type.—In the Philadelphia Academy of Natural Sciences.

This species has the habitus of an *Apanteles*, which fact, together with the indistinct, minute second cubital cell, caused Ashmead to erroneously refer it to *Urogaster*, one of the genera into which he divided *Apanteles*. It is readily separated from *xanthaspis* by the pale yellow posterior coxae and the less strongly sculptured mesonotum.

Cuba; Florida.

Known from the type and two paratype specimens from Cuba, in the Philadelphia Academy of Sciences; and eight specimens in the United States National Museum which were collected by Dr. H. G. Dyar, at Palm Beach, Florida.

7. MICROGASTER XANTHASPIS (Ashmead).

Apanteles xanthaspis ASHMEAD, Trans. London Ent. Soc., 1900, p. 280.
Microgaster xanthaspis Ashmead, MUESEBECK, Proc. U. S. Nat. Mus., vol. 58, 1920, p. 570.

Cotypes.—Two cotypes, one of each sex, are in the United States National Museum; others are in the British Museum.

At once distinguished from *iridescens* by the black posterior coxae and femora, and the confluently punctate mesoscutum.

St. Vincent; Grenada.

Known to me only from the two cotypes in the National Collection.

8. MICROGASTER BAKERI, new species.

Very similar to *xanthaspis*, from which it differs in the normal second cubital cell, and the other characters given in the table to species.

Female.—Length 2.3 mm. Face a little longer than broad, uniformly closely punctate and opaque, with a rather distinct median longitudinal carina; vertex and temples more weakly punctate and shining; antennae as long as the body; mesoscutum and scutellum uniformly closely sharply punctate and opaque, the latter distinctly convex; mesopleurae smooth and highly polished, except anteriorly, where they are closely punctate and opaque; propodeum short, rather flat, punctate or very minutely rugulose, with a prominent median carina, opaque; metapleurae almost entirely smooth and highly polished; metacarpus somewhat longer than stigma; radius arising from stigma somewhat beyond middle, perpendicular to the anterior margin of wing, and longer than the first intercubitus; second intercubitus hyaline, but distinct, and joining cubitus with the end of the first abscissa of the radius; posterior coxae more than half as long as the thorax, finely granular and opaque above; inner spur of middle tibiae a little longer than middle metatarsus; inner spur of posterior tibiae about three-fourths as long as posterior metatarsus; abdomen very slender, about as long as the thorax; the first dorsal abdominal plate very narrow, three times as long as its greatest breadth, and narrower at apex than at base, channeled down the middle, and very weakly roughened posteriorly; second abdominal tergite much shorter than the third, transverse, strongly emarginate behind, and provided with two longitudinal furrows medially, which converge slightly behind, the entire tergite smooth and shining like the remainder of the abdomen. Black; labrum, mandibles, palpi, pale; antennal scape testaceous; flagellum brownish-black; tegulae and wing-bases pale yellow; wings hyaline, stigma brown, veins pale brown; fore and middle legs entirely yellow; posterior coxae black, their trochanters yellow, their femora reddish-testaceous on the basal half, brown to black on the apical half; posterior tibiae pale yellow with a broad black band at apex; tarsi dusky except at extreme base of basal segment; abdomen black, except the first dorsal plate and the membranous margins along the two basal plates, which are reddish; venter of abdomen reddish on the basal two-thirds.

Male.—Like the female in all essential characters.

Type locality.—Louisiana.

Type.—Cat. No. 23988, U.S.N.M.

Described from one female and two male specimens from the C. F. Baker Collection, the female and one of the males from Louisiana, the other male from Kansas.

9. MICROGASTER SCHIZURAE, new species.

Closely resembles *facetosus*, but differs from that species in having the mesonotum, propodeum, and two basal abdominal tergites only weakly punctate and shining.

Female.—Length, 3.5 mm. Face confluently punctate; vertex and temples with but few shallow scattered punctures, and strongly shining; antennae about as long as the body; mesoscutum and scutellum with distinct well-separated punctures, shining; mesopleurae highly polished, with only a few weak punctures anteriorly and below; propodeum very weakly punctate, with a prominent median carina and a few irregular rugae at the sides; metapleurae smooth, highly polished; stigma as long as the metacarpus; radius nearly perpendicular to the anterior margin of the wing and much longer than the first intercubitus; posterior coxae large, more than half as long as the thorax, mostly smooth and shining, with a large elongate flattened punctate area on the outer upper edge; inner spur of middle tibiae a little longer than the middle metatarsus; inner spur of posterior tibiae at least two-thirds as long as the posterior metatarsus; abdomen as long as thorax; the first tergite broadening somewhat posteriorly, with the posterior angles evenly rounded off; second tergite transverse, about as long as the third, and provided with two nearly parallel longitudinal grooves medially; the first tergite smooth and polished except at apex, where there are a few weak punctures; the second tergite mostly smooth and polished with very few weak scattered punctures; third and following tergites wholly smooth and highly polished; hypopygium not prominent; ovipositor sheaths very short, hardly surpassing the apex of the abdomen. Black; labrum, mandibles, and palpi pale yellow; antennae testaceous below, brown above; wings hyaline; tegulae and wing-bases pale yellow; veins and stigma light brown, the latter without a pale spot at base; fore and middle legs wholly pale yellow; posterior coxae varying from black to dark red at apex; remainder of posterior legs deep testaceous, except the lower edge of the femora, which is somewhat infuscated; abdomen brownish above on the three basal tergites, black beyond; the lateral membranous margins along the two basal plates, and practically the entire venter, pale testaceous.

Male.—Essentially as in the female.

Cocoons.—Cylindrical, white, with considerable loose silk; apparently gregarious.

Type locality.—Riley County, Kansas.

Type.—Cat. No. 23990, U.S.N.M.

Hosts.—*Schizura unicornis* Smith and Abbot; *S. concinna* Smith and Abbot.

Described from the following material in the United States National Museum; two female specimens labeled "May 19, Riley Co., Kansas, Popenoe, parasitic on *Schizura unicornis* 1461"; three males reared Jan. 3, 1884, in the Bureau of Entomology, under No. 359 L–o, the host recorded as *Tinea biseliella*, which record is doubtless incorrect; one specimen taken at Lawrence, Kansas, June 19, 1896, by Hugo Kahl; and six specimens, together with cocoons, reared from *Schizura concinna*, at Westerville, Ohio, July 14, 1897. I have also seen three specimens, collected by J. A. Grossbeck, at New Brunswick, New Jersey, which are from the collection of the American Museum of Natural History.

10. MICROGASTER AURIPES Provancher.

Microgaster auripes PROVANCHER, Addit. Faun. Canad. Hymen., 1886, p. 141.

Type.—In the Museum of Public Instruction at Quebec.

Legs including all coxae bright reddish-testaceous; abdomen, except most of the first tergite and the middle of the second, which are blackish, reddish-testaceous; occasionally the apical abdominal segments are dusky medially. The two basal abdominal tergites, and part of the third rugulose.

Canada; Kansas; Virginia; Ohio; Kentucky; New York.

Host.—*Neleucania albilinea* Huebner.

The following material of this species is in the United States National Museum. Nine specimens from Riley County, Kansas; one from Onaga, Kansas; one, without locality, reared from *Neleucania albilinea;* one from Virginia, taken in August, 1879; one collected at Wooster, Ohio, July 10, 1897; one from Arlington, Virginia, one from Lexington, Kentucky, and several without locality data. I have also seen four specimens in the Cornell University Collection, one collected June 8–10, 1915, at Chipmunk Swamp, Vandalia, New York; two taken at Ithaca, New York, July 19, 1904, and July 4, 1908, respectively, by C. S. Spooner; and one labeled "Caroline-Hartford, New York, June 15."

11. MICROGASTER BREVICAUDA Provancher.

Microgaster brevicaudus PROVANCHER, Addit. Faun. Canad. Hymen., 1886, p. 140.

Diolcogaster brevicauda Provancher, ASHMEAD, In Smith's Ins. N. J., 1900, p. 594.

Type.—In the Museum of Public Instruction at Quebec.

Point Rouge, Canada.

This species has been assigned its place in the key on the basis of the original description, and notes made by Mr. A. B. Gahan. I have seen no authentic material. There are two specimens in the collection of the Philadelphia Academy of Sciences which are labeled *brevicaudus*, but I question the correctness of this determination.

12. MICROGASTER FACETOSA Weed.

Microgaster facetosa WEED, Trans. Amer. Ent. Soc., vol. 15, 1888, p. 296.

Microgaster (*Diolcogaster*) *solidaginis* VIERECK. Bull. Conn. State Geol. and Nat. Hist. Survey., 1917 (1916), p. 202.

Type.—Two specimens, at least one of them, labeled "Type 2," belonging to Weed's type series of two specimens, are in the United States National Museum. The type of *solidaginis* is in the collection of the Connecticut Agricultural Experiment Station at New Haven.

This species is extremely variable both as to color and sculpture. The mesonotum, propodeum and first three abdominal tergites are strongly roughened in the female, but usually much less so in the male; the female normally has considerable testaceous coloring on the third and fourth tergites; while in the male rarely more than a narrow transverse band along the posterior margin of third tergite is testaceous, and frequently the dorsum is wholly black.

Illinois; Connecticut; Tennessee; Ohio; Maryland; Pennsylvania; Michigan; Colorado; Kansas; New York; Massachusetts; Vermont; New Hampshire; Maine; Washington; British Columbia; and Ontario, Canada.

Host.—*Plathypena scabra* Fabricus.

In addition to the type material mentioned above I have seen many specimens from diverse localities. In the National Collection there are, besides the two specimens which are apparently Weed's types, eight specimens reared by C. C. Hill, in the Bureau of Entomology, under Webster No. 8337, from *Plathypena scabra*, at Nashville, Tennessee; eight others reared from the same host, by the same worker, at Knoxville, Tennessee; one specimen from Wooster, Ohio; one from Fort Washington, Maryland; one from Agricultural College, Michigan; several specimens from the C. F. Baker Collection, taken in Pennsylvania, Michigan, Colorado, Kansas, and Canada; and two specimens reared by H. L. Parker, July, 1915, from *Plathypena scabra*, at Hagerstown, Maryland. In the collection of the Boston Society of Natural History there is one specimen collected by Mr. C. W. Johnson at Jaffrey, New Hampshire. Doctor Brues's collection at Harvard University contains specimens from Blue Hills and Woods Hole, Massachusetts; Mount Constitution and Index, Washington; Dummerston, Vermont; Calais, Maine; and Lake McDonald, Glacier Park, Montana; and in the Cornell University Collection there are specimens from the following localities: Slaterville, Caroline, Hartford, Freeville, Rock City, West Danby, and Waterville, in New York State; Woods Hole, Massachusetts; Waubamic, Ontario; and Carbonate, British Columbia.

13. MICROGASTER RUBRICOXA Provancher.

Microgaster rubricoxus PROVANCHER, Addit. Faun. Canad. Hymen., 1888, p. 386.

Hygroplitis rubricoxus Provancher, ASHMEAD, in Smith's Ins. N. J., 1900, p. 594.

Type.—In the Museum of Public Instruction at Quebec.

This species is very distinct from all other species of *Microgaster*, in that the propodeum is almost horizontal; also in possessing a fine but distinct crenulate furrow on the mesopleurae; in the somewhat shorter tibial spurs; and the very large apical tarsal segment. The abdomen is long, with nearly parallel sides; the first two abdominal tergites large and coarsely rugose; the third and fourth tergites are usually partly testaceous, also the venter of the abdomen, and the posterior coxae.

Canada; New York; Massachusetts; Maine.

Host.—Unknown.

The National Collection contains a homotype (determined by Gahan), from Ottawa, Canada; one other specimen from the same locality; one from Long Island, New York; one from Ithaca, New York; and one labeled "Cana. 2068, Collection C. F. Baker." I have seen in Doctor Brues's collection five specimens from Woods Hole, one from Fall River, and one from Essex County, Massachusetts. The collection of the Boston Society of Natural History has five specimens collected by Mr. C. W. Johnson on Mount Desert, Maine, and two taken by the same collector at Williamsburg, Massachusetts. The Cornell Collection contains a single specimen from Spring Lake, Cayuga County, New York.

14. MICROGASTER MELLIGASTER Provancher.

Microgaster melligaster PROVANCHER, Addit. Faun. Canad. Hymen., 1886, p. 143.

Diolcogaster melligaster Provancher, ASHMEAD, Proc. U. S. Nat. Mus., vol. 23, 1900, p. 132.

Type.—In the Museum of Public Instruction at Quebec, Canada.

I have seen no specimens of this species. It has been assigned its place in the key on the basis of the original description, and notes by Mr. Gahan, made upon an examination of the type.

15. MICROGASTER HARNEDI, new species.

Very similar to *pantographae*, from which it can be separated however, by the characters noted in the table to species.

Female.—Length 4 mm. Face ruguloso-punctate, with a short polished median ridge below antennal fossae; clypeus well separated from face; vertex and temples weakly punctate and shining; antennae nearly as long as the body; mesoscutum punctate and shining anteriorly and below; propodeum coarsely rugose, with a prominent median longitudinal carina; stigma a little shorter than metacarpus and hardly twice as long as broad; radius arising far out on stigma, the inner side of the latter about twice as long as the outer; radius tending strongly outward, much longer than the first intercubitus; posterior coxae large; inner spur of middle tibiae at least as long as middle metatarsus; inner spur of posterior tibiae much more than half as long as the posterior metatarsus; abdomen broad, stout, nearly as long as the thorax; the first tergite very large, broadening toward apex, where it is nearly as broad as long, very coarsely rugose; second tergite transverse, longer than third, and three times as broad as long, entirely coarsely rugose; third tergite somewhat punctate and indistinctly striate on basal half, polished beyond; the following tergites smooth and polished; hypopygium strongly developed; ovipositor sheaths more than two-thirds as long as the abdomen, broad, broadest a little beyond the middle, from which point they taper somewhat toward apex. Black; mouth parts and antennae usually blackish; tegulae and wing-bases transparent-yellow; wings entirely hyaline, the veins and stigma dark brown, the latter pale at base; legs, including all coxae, testaceous, except extreme apex of posterior femora, the apical third of posterior tibiae, and the posterior tarsi, which are fuscous; abdomen black; the venter testaceous on basal half; ovipositor sheaths black.

Type locality.—Agricultural College, Mississippi.

Type.—Cat. No. 23991, U.S.N.M.

Host.—*Pyrausta ainslei* Heinrich; *Diatraea*, species.

Described from two female specimens, the type reared from *Pyrausta ainslei*, by R. W. Harned, August 23, 1920, at Agricultural College, Mississippi; the paratype reared from a *Diatraea* larva in cornstalk, at Bentonville, South Carolina, August 31, 1915, by E. R. Barber.

16. MICROGASTER PANTOGRAPHAE, new species.

Very similar to *harnedi*, also to *gelechiae*. It differs from the former in the much longer stigma, the basally black posterior coxae, and in the ovipositor sheaths being broadest at apex; from *gelechiae* it is distinguished by the clear hyaline wings, and by the apex of the posterior tibiae and the posterior tarsi being strongly infuscated.

Female.—Length 4.2 mm. Face confluently punctate and shining, with a short polished median carina below antennal fossae; vertex almost impunctate; temples weakly punctate and shining; mesoscutum weakly punctate anteriorly, impunctate and polished behind; scutellum impunctate and highly polished; mesopleurae shallowly punctate and strongly shining anteriorly and below, polished posteriorly and on the upper half, and without a crenulate furrow; propodeum coarsely rugose, with a prominent median carina; stigma large, almost as long as the metacarpus; radius arising a little beyond the middle of stigma, tending strongly outward, and much longer than first intercubitus; posterior coxae large, half as long as the thorax; inner spur of middle tibiae as long as the basal segment of their tarsi; inner spur of posterior tibiae much more than half as long as posterior metatarsus; abdomen as long as the thorax, broad, stout; the first tergite large, broadening posteriorly, a little broader at apex than long down the middle, entirely coarsely rugose; second tergite transverse, about three times as broad as long, and longer than the third tergite, its posterior margin nearly straight, and, like the first tergite, entirely coarsely rugose; the third abdominal tergite weakly roughened on the basal half, at least medially; remainder of the dorsum of the abdomen smooth and shining; hypopygium large, but not surpassing the apex of the last dorsal abdominal segment; ovipositor sheaths broad and about two-thirds as long as the abdomen, broadening gradually posteriorly, broadest at apex. Black; labrum and mandibles red; labium and palpi pale yellow; antennae dark brown; tegulae and wing-bases bright testaceous; wings entirely hyaline, not at all clouded apically; veins and stigma pale brown; anterior and middle legs, including coxae, wholly pale yellow; posterior coxae black at base, testaceous on apical half; remainder of the posterior legs testaceous, except the extreme apex of femora, apex of tibiae and the tarsi, which are fuscous; abdomen entirely black above, yellowish beneath on the basal half or two-thirds; ovipositor sheaths black.

Type locality.—Bangor, Maine.

Type.—Cat. No. 23992, U.S.N.M.

Host.—Pyralid leaf-roller on linden, probably *Pantographa lineata* Grote and Robinson; also *Gelechia cerceriseIla* Chambers.

Described from two female specimens reared from the linden leaf-roller taken in Mount Hope Cemetery, Bangor, Maine, 1883. The National Collection contains the following additional material: three specimens, without locality label, reared August 4, 1899, from the linden leaf-roller; another without locality, labeled "*Pantographa lineata*"*;* one specimen reared by C. Heinrich from *Gelechia cerceriseIla*, at Great Falls, Virginia, under Hopkins U. S. No. 11187-b; and one specimen labeled "Cana. 2068, Collection C. F. Baker." I have also seen three specimens of this species, taken at Ithaca, New York, in the Cornell University Collection; and one specimen in the Collection of the Boston Society of Natural History, which was taken by J. A. Cushman, at Tisbury, Massachusetts, July, 1913.

17. MICROGASTER BRITTONI Viereck.

Microgaster (*Microgaster*) *brittoni* VIERECK, Bull. 22, Conn. State Geol. and Nat. Hist. Survey, 1917 (1916), p. 202.

Type.—In the Connecticut State Agricultural Experiment Station, at New Haven.

Wings slightly fuliginous apically; scutellum small, flat, smooth and polished; propodeum coarsely rugose and dull; first abdominal tergite about as broad at apex as long down the middle; the first and second tergites rugose; tegulae usually blackish; all coxae black; apex of posterior femora and tibiae, and the posterior tarsi, fuscous; third and fourth abdominal tergites more or less, and practically the entire venter of abdomen, testaceous.

Connecticut; New York; Massachusetts; Canada.

The male type specimen, from Kent, Connecticut, is the only specimen in the collection of the Connecticut Experiment Station. The National Collection contains six specimens, three without locality label; one from Ithaca, New York; and two taken in Canada, from the C. F. Baker Collection. I have seen one specimen in the collection of the Boston Society of Natural History, which was collected by Mr. C. W. Johnson, at Brookline, Massachusetts; and six specimens in the Cornell University Collection from the following localities: Spencer Lake, Otto, Ithaca, Rochester Junction, and Taughannock, New York; and Woods Hole, Massachusetts.

18. MICROGASTER GELECHIAE Riley.

Microgaster gelechiae RILEY, First Ann. Rpt. Insects Mo., 1869, p. 178.

Type.—In the United States National Museum.

Readily distinguished by the characters given in the table to species.

Missouri; Wisconsin; Maryland; Virginia; Massachusetts; Louisiana; New York.

Host.—*Gnorimoschema gallaesolidaginis* Riley.

In addition to the types the United States National Museum Collection contains the following material—two specimens, from Vienna, Virginia, reared by R. A. Cushman, from the above-named host in the Bureau of Entomology, under Quaintance No. 7803; two specimens with the same host, locality and collector data, reared under Quaintance No. 7803; twenty specimens reared by Mr. Cushman, at Great Falls, Virginia, from *G. gallaesolidaginis;* three reared from the same host at Tullalah, Louisiana, under Hunter No. 1931; and collected specimens from Wisconsin; Cedar Point, Maryland; and Provincetown, Massachusetts. There is one specimen in the Cornell Collection, from Otto, New York.

19. MICROGASTER SWAMMERDAMIAE, new species.

The distinct punctation of the entire mesoscutum and scutellum and the short ovipositor will readily distinguish this species from its closest allies, *carinata*, *canadensis*, and *congregatiformis*.

Female.—Length, 2.8 mm. Face a little broader than long, with closely placed distinct punctures, and with an indistinct shining median tubercle below the antennal fossae; antennae distinctly longer than the body, mesoscutum entirely distinctly punctate, shining; scutellum large, nearly flat, more feebly, but distinctly, punctate; mesopleurae mostly smooth and polished, only weakly punctate anteriorly and below; propodeum rugulose, with a prominent median longitudinal carina; stigma broad, shorter than the metacarpus; radius arising slightly beyond middle of stigma, somewhat directed backward, only a little longer than the first intercubitus; posterior coxae at least half as long as thorax, mostly polished, with a flattened punctate area on the outer upper edge; inner spur of middle tibiae a little longer than middle metatarsus; inner spur of posterior tibiae two-thirds as long as posterior metatarsus; abdomen narrower than, and about as long as, thorax, at least two and one-half times as long as broad; first tergite broadening posteriorly, indistinctly longer than broad at apex, finely rugulose; second tergite transverse, slightly more than twice as broad as long, and distinctly longer than the third, very finely rugulose, the suture between it and the third very minutely crenulate and straight; third tergite practically entirely smooth and shining, with only a faint suggestion of roughening at the extreme base medially, remainder of dorsum of abdomen smooth and shining; ovipositor sheaths slender, projecting only one-fourth the length of the abdomen. Black; labrum and apex of mandibles reddish; labium and palpi pale yellow; antennae wholly brownish black; tegulae black; wings hyaline, with the apical half weakly fuliginous; all coxae black; remainder of the legs bright yellow, except the extreme apex of posterior femora and tibiae and the posterior tarsi, which are infuscated. Abdomen black above; the narrow membranous margins along the first and second tergites and most of the venter, pale yellow; sometimes the third tergite is pale at extreme sides.

Male.—Like the female in all essential characters.

Cocoons.—4.5 mm. long, cylindrical, white, thin, with an indistinct semitransparent band near the middle.

Type locality.—East River, Connecticut.

Type.—Cat. No. 23993, U.S.N.M.

Host.—*Swammerdamia castaneae* Busck.

Described from four female and eight male specimens reared by C. R. Ely at East River, Connecticut, August 4, 1917. There is in the National Collection also one male specimen reared from *Swammerdamia* on black birch by C. R. Ely at East River, Connecticut, August 19, 1917.

20. MICROGASTER CARINATA Packard.

Microgaster carinata PACKARD, Proc. Boston Soc. Nat. Hist., vol. 21, 1880, p. 25.

Microgaster gelechiae, var. *carinata* RILEY, Amer. Natural, vol. 16, 1882, p. 679.

Type.—In the United States National Museum.

Readily distinguished by the characters given in the key to species.

Massachusetts (?)

Host.—*Vanessa atalanta* Linnaeus (Packard).

Known only from the type material.

21. MICROGASTER COMPTANAE Viereck.

Microgaster comptanae VIERECK, Proc. U. S. Nat. Mus., vol. 39, 1911, p. 403.

Type.—In the United States National Museum.

Face very weakly punctate and strongly shining, with no indication of a median carina below antennal fossae; posterior femora, tibiae and tarsi, wholly testaceous; third abdominal tergite entirely smooth.

Rocky Ford, Colorado.

Host.—*Ancylis comptana* Frölich.

Known only from the two specimens of the type series.

22. MICROGASTER CANADENSIS, new species.

Very similar to *comptanae* Viereck, from which it can be distinguished by the rugulose face, by the posterior tibiae at apex and the posterior tarsi being infuscated, and by its larger size.

Female.—Length 3.3 mm. Face finely rugulose and opaque; vertex polished; temples weakly punctate and shining; antennae very slightly shorter than the body; mesoscutum punctate anteriorly, impunctate and polished posteriorly; scutellum flat, impunctate, polished; mesopleurae practically entirely impunctate and polished, with a smooth, dimple-like impression posteriorly; propodeum rugose, with a prominent median carina; stigma about as long as metacarpus; radius arising a little beyond middle of stigma and somewhat directed outward; posterior coxae smooth and polished, about half as long as thorax; inner spur of middle tibiae as long as middle metatarsus; inner spur of posterior tibiae two-thirds as long as posterior metatarsus; abdomen broad, as long as thorax, and about twice as long as its greatest breadth; first abdominal tergite broadening posteriorly, about as broad at apex as long, rugose; second tergite transverse, more than three times as broad as long, no longer than third; suture between second and third tergites minutely crenulate and distinctly curving forward at the sides, so that the second tergite is longest medially; third tergite, like the following, smooth and polished; ovipositor sheaths a little more than half as long as the abdomen, broadening gradually toward apex. Black; mouthparts piceous; antennae black; tegulae and wing-bases black; wings hyaline, the apical third very weakly fuliginous; all coxae and basal segment of trochanters black; remainder of legs testaceous, except a small spot on the lower side of posterior femora at base, the apices of posterior femora and tibiae, and the posterior tarsi, which are blackish; abdomen wholly black.

Male.—Differs from female only in the longer antennae, in the second abdominal tergite being longer than the third, and in the suture between second and third tergites not curving forward so distinctly at the sides.

Type locality.—Canada.

Type.—Cat. No. 23995, U.S.N.M.

Described from six female and seven male specimens labeled "Cana. 2156, Collection C. F. Baker."

Besides the type series, which is in the National Collection, I have seen the following material of this species: one specimen, in the Boston Society of Natural History, collected by Mr. C. W. Johnson, at Auburndale, Massachusetts; one specimen in Doctor Brues's collection, from Hyannis Point, Massachusetts; and one from the collection of the American Museum of Natural History, taken at Nyack, New York, by J. L. Zabriskie.

23. MICROGASTER FEMORALIS, new species.

Very close to *phthorimaeae*. It differs from that species in the black femora, in the more punctate and less polished mesoscutum, the smaller scutellum, the more finely striate third tergite, the narrower and unicolorous stigma, and the somewhat shorter ovipostor.

Female.—Length 2.8 mm. Face prominent, broader than long, finely punctate, and with a more or less distinct shining tubercle below the antennal fossae; vertex impunctate, polished; temples very shallowly punctate and shining; antennae a little shorter than the body; mesoscutum entirely distinctly though shallowly punctate, shining; scutellum small, very slightly convex, impunctate and polished; mesopleurae weakly punctate anteriorly and below, but mostly polished; propodeum rugose, with a median longitudinal carina; stigma rather narrow, and about as long as the metacarpus; radius arising far out on stigma, rather strongly curved; second cubital cell small; posterior coxae about half as long as the thorax, mostly smooth and shining, without a distinct flattened area on the outer edge at base; inner spur of middle tibiae a little longer than middle metatarsus; inner spur of posterior tibiae two-thirds as long as the posterior metatarsus; abdomen about twice as long as broad, and nearly as long as the thorax; first tergite broadening posteriorly, as broad at apex as long, entirely rugose; second tergite transverse, nearly three times as broad as long, longer than the third, entirely rugose, and separated from the third by a sharp crenulate suture that distinctly curves forward laterally; third tergite distinctly delicately aciculated on the basal two-thirds; remainder of the abdomen smooth and shining; ovipositor sheaths narrow, about half as long as the abdomen. Black; mouthparts, including labial palpi and the two basal segments of the maxillary palpi, black; antennae, tegulae and wing-bases black; wings very weakly fuliginous, the median cell hyaline; veins and stigma brown, the latter without a pale spot at base; all coxae and trochanters black; fore and middle femora black on the basal half; posterior femora dark reddish-brown, tinged with blackish, remainder of the legs mostly yellowish-brown; abdomen wholly black.

Male.—Like the female, except that the antennae are longer than the body, the abdomen is more slender, the posterior femora are entirely black, and the mesoscutum is not so distinctly punctate posteriorly.

Type locality.—Tuolumne Meadows, Soda Springs, California.

Type.—Cat. No. 23996, U.S.N.M.

Described from one female and one male taken by G. R. Pilate at the above locality, August 8, 1916.

24. MICROGASTER PHTHORIMAEAE, new species.

Closely resembles *congregatiformis*, from which it differs in wanting the prominent median facial carina, in the black tegulae, in the shorter and narrower ovipositor sheaths, and in wanting the conspicuous dusky spot on the fore wing just below stigma.

Female.—Length 3.3 mm. Face closely punctate, with a more or less distinct shining median tubercle below antennal fossae, but without a strong median carina; vertex practically impunctate, polished; temples very weakly punctate and shining; antennae about as long as the body; mesoscutum closely shallowly punctate anteriorly, impunctate and polished behind; scutellum flat, impunctate, polished; mesopleurae highly polished, and without a crenulate furrow, but with a dimple-like impression posteriorly; propodeum coarsely rugose, with a prominent median longitudinal carina; metapleurae coarsely rugose; stigma subequal in length with the metacarpus; radius curved, directed outward; coxae half as long as the thorax, mostly polished, with an elongate flattened punctate area on the outer upper edge at base; inner spur of middle tibiae as long as the middle metatarsus; inner spur of posterior tibiae much more than half as long as the posterior metatarsus; abdomen broad, not quite as long as thorax, and hardly twice as long as its greatest breadth; first abdominal tergite as broad at apex as long, and coarsely rugose, second tergite transverse, two and one-half times as broad as long, entirely rugose; the crenulate suture between the second and third tergites distinctly curving forward at the sides; the first and second tergites together covering about two-thirds of the dorsum of the abdomen; third abdominal tergite finely striate on the basal half of the middle two-thirds, smooth and polished beyond like the following tergites; hypopygium not surpassing the apex of the last dorsal abdominal segment; ovipositor sheaths slightly more than half as long as the abdomen. Black; palpi blackish at base; antennae, tegulae and wing-bases, black; wings hyaline, very feebly fuliginous on the apical third; veins and stigma brown, the latter with a distinct pale spot at base; all coxae and basal segment of all trochanters black; remainder of legs testaceous, except a very small black spot on the under side of the anterior and middle femora at base, and the extreme apex of the posterior femora and tibiae, and more or less of the posterior tarsi, which are dusky; abdomen wholly black.

Male.—As in the female except that the abdomen is a little more slender.

Type locality.—Oxnard, California.

Type.—Cat. No. 23994, U.S.N.M.

Hosts.—*Phlyctaenia ferrugalis* Hübner; *P. operculella* Zeller.

Described from three female and three male specimens reared by R. L. Boyden, from *P. ferrugalis*, in the Bureau of Entomology, under Chittenden No. 3106–02, at Oxnard, California.

There is in the National Collection also a series of three specimens reared by J. E. Graf, from *P. operculella*, at Pasadena, California, under Chittenden No. 2230. I have seen another specimen in Doctor Brues's collection from Los Angeles, California.

25. MICROGASTER EPAGOGES Gahan.

Microgaster epagoges GAHAN, Proc. U. S. Nat. Mus., vol. 53, 1917, p. 197.

Type.—In the United States National Museum.

Readily placed by use of the characters given in the table to species.

Tennessee, Illinois, Indiana, Colorado, Massachusetts, New York.

Host.—*Epagoge sulfureana* Clemens.

Besides the type series from Nashville, Tennessee, the National Collection has one specimen reared at Galena, Illinois, and two reared at Lafayette, Indiana, by J. J. Davis, also one specimen labeled "Colo. 2082 Collection C. F. Baker." Doctor Brues's Collection, at Harvard University, contains a single specimen, taken at Forest Hills, Massachusetts, by P. W. Whiting; and the Cornell University Collection has one specimen taken at Ithaca, New York.

26. MICROGASTER CONGREGATIFORMIS Viereck.

Microgaster (Microgaster) congregatiformis VIERECK, Bull. 22, Conn. State Geol. and Nat. Hist. Survey, 1917 (1916), p. 202.

Type.—In the Connecticut Agricultural Experiment Station.

The characters noted in the key to species will separate this species from *epagoges* and *phthorimaeae*, to which it is most closely allied.

Connecticut, Massachusetts, New York, Canada.

Host.—*Physostesia*, species.

A paratype from New Haven, Connecticut, is in the National Collection; also a female specimen, from the same locality, reared by Dr. W. E. Britton, from *Physostesia*, species, July 16, 1918. The collection of Cornell University contains one specimen, from Montreal, Canada; in Doctor Brues's collection there are three specimens from Franklin, Massachusetts; and in that of the American Museum of Natural History there is a single specimen from Long Island, New York, taken by J. L. Zabriskie.

SPECIES OF MICROGASTER UNKNOWN TO ME.

MICROGASTER MEXICANA Cameron.

Microgaster mexicanus CAMERON, Biol. Cent. Amer. Hym., vol. 1, 1883, p. 397.

Type.—Probably in the British Museum.

Mexico, Northern Sonora (Morrison).

This species may not belong to *Microgaster*. Cameron's characterization of the abdomen causes me to suspect that it is a *Microplitis*.

MICROGASTER LATERALIS Provancher.

Microgaster lateralis PROVANCHER, Addit. Faun. Canad. Hymen., 1886, p. 141.

Type.—In the Museum of Public Instruction at Quebec.

Point Rouge, Canada.

The notes made by Mr. A. B. Gahan upon this species, after an examination of the type, mention the second intercubitus as being represented merely by a fuscous line, the second cubital cell being open at the apex. This character, together with the long ovipositor and the sculpture of the abdomen, mentioned by Provancher, lead me to doubt that the species is correctly placed. I suspect that it may be an Apanteles, possibly falling near *consimilis*.

SPECIES WRONGLY CLASSIFIED AS MICROGASTER WHICH HAVE NOT PREVIOUSLY BEEN REMOVED FROM THAT GENUS.

APANTELES UNICOLOR (Curtis).

Microgaster unicolor CURTIS, Descr. Insects J. C. Ross, 2d Voyage, 1835, Appendix, p. 62.

Type.—Probably in the British Museum. Arctic Regions, North America.

The description given by Curtis is clearly that of an *Apanteles*. Apparently the species falls close to *yakutatensis* Ashmead.

MICROGASTER BISSTIGMATA Say.

Microgaster bisstigmata SAY, Boston Journ. Nat. Hist., vol. 1, 1836, p. 264.

Type.—Lost.

Indiana.

This is certainly not a *Microgaster*, since the description states that the radial vein is distinct and complete. It may very well be an *Orgilus*.

(MICROGASTER TUCKERI Viereck)=MICROPLITIS MATURUS Weed.

Microplitis maturus WEED, Trans. Amer. Ent. Soc., vol. 15, 1888, p. 294.
Microgaster tuckeri VIERECK, Trans. Kansas Acad. Sci., vol. 19, 1905, p. 274.

Type.—In the University of Kansas.

Douglas County, Kansas.

I have not seen the type of *tuckeri*, but Mr. Gahan, in notes made on an examination of the type several years ago, states that it is a *Microplitis;* and according to these notes and Viereck's description, the species agrees in every detail with *maturus* Weed.

Genus MICROPLITIS Foerster.

Microplitis FOERSTER, Verh. der Naturh. Ver. preuss. Rheinl., vol. 19, 1862, p. 245. *Genotype.*—*Microgaster sordipes* Nees (Monobasic).

Distinguished from *Microgaster* and *Apanteles* by the characters given in the key to genera. Most of the species are properly placed in this genus without difficulty. They have the characters mentioned well-marked, and also have a distinct habitus and are usually of smaller size, but several species, such as *carinatus*, *perplexus*, *coloradensis*, and *stigmaticus* must be very carefully studied before they can be referred to *Microplitis*.

In habits the members of this genus are similar to the species of *Apanteles* and *Microgaster*. All attack lepidopterous larvae, some living as solitary, others as gregarious, parasites within the body of the host. The genus as a whole is probably somewhat more beneficial than *Microgaster*, although it has but few more species, in North America. Noctuid larvae, and more particularly the cutworms, appear to be especially subject to the attacks of species of *Microplitis*.

For the most part the cocoons are different from those of *Apanteles* and *Microgaster*. They are usually parchment-like, often fluted or ribbed, always buff, brown, gray, or greenish in color, and without loose silk. No *Microgaster* cocoon known to me resembles those of *Microplitis*, and the cocoons of only a few species of *Apanteles* can be confused with them.

KEY TO THE NORTH AMERICAN SPECIES OF MICROPLITIS.

1. Second abdominal tergite emarginate posteriorly, provided with two longitudinal grooves medially, and usually somewhat roughened; stigma large; radius decidedly longer than first intercubitus and usually perpendicular to anterior margin of stigma; inner spur of posterior tibiae always half as long as metatarsus; stigma broad, as long as the metacarpus. Large species, always more than 3 mm. in length---------------------------- 2.

Second adbominal tergite not emarginate posteriorly, nor provided with longitudinal grooves medially; otherwise not combining the above characters -- 5.

2. First dorsal abdominal plate distinctly narrower at apex than at base; stigma exceedingly large and with a pale spot at base. 1. **stigmaticus**, new species.

First dorsal abdominal plate either parallel-sided throughout, or a little broader at apex than at base; stigma unicolorous---------------------- 3.

3. Face without a distinct median carina extending from antennal fossae to clypeus; legs, including all coxae and femora wholly testaceous. 2. **rugosus**, new species.

Face with a distinct median carina extending from antennal fossae to clypeus; at least the posterior coxae and femora partly black------------ 4.

4. Posterior coxae granular and opaque above; second abdominal tergite somewhat roughened laterally; median area on second tergite triangular in outline, and broadest at base; scutellum coarsely rugulose and opaque. 3. **coloradensis**, new species.

Posterior coxae smooth and shining above; second abdominal tergite wholly polished, the median area slender, not triangular; scutellum with separate punctures, shining-------------------------- 4. **perplexus**, new species.

5. Metacarpus much longer than stigma; posterior coxae half as long as thorax; propodeum smooth and polished, with a median longitudinal carina; second abdominal tergite short, transverse, somewhat roughened. 5. **carinatus** Ashmead.

Metacarpus never longer, usually shorter, than the stigma; posterior coxae never half as long as the thorax; propodeum always rugulose----------6.

6. First dorsal abdominal plate slightly broader at apex than at base, very rarely not distinctly broader at apex than at base, and then the parapsidal grooves distinctly impressed------------------------------------7.

First dorsal abdominal plate not at all broader at apex than at base, usually decidedly narrower; if base and apex are of equal breadth, the parapsidal grooves are not at all impressed------------------------------------14.

7. Parapsidal grooves wholly wanting, the mesoscutum and scutellum weakly punctate and shining; length 2.5 mm------------- 6. **kewleyi**, new species.

Parapsidal grooves distinct; length always more than 3 mm--------------8.

8. Legs, including all coxae, bright testaceous; venter of abdomen mostly testaceous--9.

At least the posterior coxae black; venter usually mostly blackish---------10.

9. Stigma unicolorous; parapsidal grooves very strongly impressed; scutellum very broad, broader at base than long; first dorsal abdominal plate about one and one-half times its greatest breadth-- 7. **crenulatus** (Provancher).

Stigma with a large pale spot in the membrane at base; parapsidal grooves fine, and not so strongly impressed; scutellum a little longer than broad at base; first dorsal abdominal plate distinctly twice as long as its greatest breadth------------------------------------- 8. **mamestrae** Weed.

10. Stigma with a distinct pale spot in the membrane at base; dorsum of abdomen sometimes more or less testaceous beyond second tergite----------11.

Stigma unicolorous, very rarely with the costal thickening at base of stigma pale; dorsum of abdomen never testaceous---------- 12.

11. Abdomen broad and stout; the venter and most of the dorsum beyond second tergite testaceous; tegulae yellow.
9. **quadridentatus** (Provancher).

Abdomen more slender, wholly black; tegulae usually black.
10. **alaskensis** Ashmead.

12. Tegulae black; all coxae and basal segment of trochanters black; fore wing with a distinct slightly fuliginous patch extending across the first cubital and first discoidal cells---------- 11. **autographae**, new species.

Tegulae yellow---------- 13.

13. Fore and middle coxae yellowish; scape testaceous below; parapsidal grooves deep and coarsely roughened---------- 12. **hyphantriae** Ashmead.

All coxae dark brown or black; scape wholly black; parapsidal grooves usually not so deep and coarsely roughened---------- 13. **ceratomiae** Riley.

14. Posterior femora short and stout, not more than three times as long as their greatest breadth; vertex, temples, cheeks and mesoscutum smooth and subpolished, with only indistinct, exceedingly minute punctures; temples bulging slightly beyond the line of the eyes; tegulae and all coxae black; remainder of legs bright testaceous; first dorsal abdominal plate twice as long as broad, base and apex of equal breadth, mostly smooth and polished; length more than 3.5 mm---------- 15.

Posterior femora not so stout; otherwise not combining all the above characters---------- 16.

15. Wings strongly infumated---------- 14. **croceipes** (Cresson).

Wings hyaline---------- 15. **longicaudus**, new species.

16. First dorsal abdominal plate mostly smooth and polished; dorsum of abdomen always black; mesoscutum never with distinct parapsidal grooves---------- 17

First dorsal abdominal plate largely rugulose, rarely mostly smooth, and then the abdomen is more or less testaceous above, or the parapsidal grooves are distinctly impressed---------- 24.

17. Mesoscutum and scutellum only weakly indistinctly punctate and usually very strongly shining; first dorsal abdominal plate about as broad at apex as at base---------- 18.

Mesoscutum and scutellum sharply, often confluently, punctate and opaque; first dorsal abdominal plate distinctly narrower at apex than at base---------- 19.

18. Scutellum very small, flat, almost polished; legs, except coxae, mostly testaceous; basal segment of antennal flagellum in female, distinctly longer than the second; length not over 2.5 mm---------- 16. **gortynae** Riley.

Scutellum large, convex; middle and posterior femora black; basal segment of antennal flagellum not distinctly longer than the second; length, 3.5 mm---------- 17. **nigritus**, new species.

19. Wings clear hyaline or whitish-hyaline; stigma with a large pale spot in the membrane at base; posterior femora mostly testaceous---------- 20.

Wings either slightly fuliginous or hyaline, but if hyaline, posterior femora are black; stigma nearly always unicolorous---------- 21.

20. Stigma decidedly more than twice as long as its greatest breadth; tegulae black; face, vertex, temples and cheeks coarsely punctate and opaque.
18. **melianae** Viereck.

Stigma not more than twice as long as its greatest breadth; tegulae usually yellow; face, vertex, temples and cheeks much more weakly punctate and shining---------- 19. **brassicae**, new species.

21. Wings hyaline; posterior femora black; tegulae black or dark brown --- 22.
Wings slightly fuliginous; posterior femora mostly testaceous, occasionally somewhat infuscated along edges --- 23.

22. Stigma unicolorous --- 20. **plutellae**, new species.
Stigma with a pale spot at base --- 21. **coactus** Lundbeck.

23. Scutellum coarsely confluently punctate and opaque; tegulae brown; first dorsal abdominal plate parallel-sided to near the apex, from which point it narrows suddenly --- 22. **quintilis** Viereck.
Scutellum flat, with scattered, well-separated punctures, somewhat shining; tegulae yellow, rarely pale brown; first dorsal abdominal plate narrowing more gradually from base to apex --- 23. **feltiae**, new species.

24. Radius perpendicular to anterior margin of stigma and much longer than first intercubitus; second dorsal abdominal plate somewhat roughened --- 25.
Radius always strongly directed outward, and usually hardly as long as first intercubitus; dorsum of abdomen beyond first segment wholly smooth and polished --- 26.

25. Mesopleural furrow distinct, crenulate; second dorsal abdominal plate very weakly roughened posteriorly; third abdominal tergite smooth and polished; face very shallowly punctate and shining.
24. **latistigmus**, new species.
Mesopleural furrow wanting; second dorsal abdominal plate finely granular on basal half, distinctly striate on posterior half, opaque; third tergite alutaceous, opaque; face closely sharply punctate and dull.
25. **striatus**, new species.

26. Metacarpus as long as stigma; all coxae, except extreme base of posterior pair, testaceous; first dorsal abdominal plate narrowing very strongly to apex; second plate triangular; second and third abdominal tergites largely testaceous; length 2.5 mm --- 26. **varicolor** Viereck.
Metacarpus not as long as stigma; otherwise not combining all the above characters --- 27.

27. Tegulae and wing-bases black; stigma without a distinct pale spot at base; disk of scutellum with a pitted groove just inside the sharp lateral margins; abdomen entirely black above and below; all coxae black.
27. **scutellatus**, new species.
Tegulae and wing-bases yellow; stigma always with a large pale spot in the membrane at base; disc of scutellum normal; abdomen often partly testaceous; fore and middle coxae, and often the posterior pair partly, yellowish --- 28.

28. Parapsidal grooves wholly wanting --- 29.
Parapsidal grooves rather well indicated --- 31.

29. Posterior coxae black; length not over 2.5 mm --- 30.
Posterior legs, including coxae, testaceous; abdomen with a broad testaceous band covering second and third tergites --- 28. **laticinctus**, new species.

30. First dorsal abdominal plate as broad at apex as at base; second and third abdominal tergites and the venter of abdomen usually testaceous.
29. **confusus**, new species.
First dorsal abdominal plate distinctly narrower at apex than at base; abdomen black, except the broad membranous margins along the two basal plates, which are pale --- 30. **bradleyi**, new species.

31. Mesopleurae mostly polished; posterior coxae reddish-black; dorsum of abdomen reddish-black; venter black; length less than 3 mm.
31. **montanus**, new species

Mesopleurae largely opaque, with only a small subquadrate polished area; posterior coxae and more or less of the dorsum of abdomen usually testaceous; venter of abdomen always testaceous; length usually 3.5 mm.
32. maturus Weed.

1. MICROPLITIS STIGMATICUS, new species.

Closely resembles *coloradensis*, from which it differs in the first dorsal abdominal plate being distinctly narrower at apex than at base, in having the mesoscutum and scutellum less coarsely roughened, in the paler legs, and in the stigma being pale at base.

Female.—Length 3.2 mm. Face very weakly indistinctly punctate and shining; antennae very slender, a little longer than the body; vertex, temples, and cheeks indistinctly punctate and shining; mesoscutum shallowly, confluently punctate; parapsidal grooves not distinct; scutellum very weakly punctate, shining; mesopleurae punctate anteriorly and below the rather short, finely crenulate, longitudinal furrow, highly polished above it; propodeum sloping gradually from base to apex, finely rugulose, and provided with a median longitudinal carina; stigma exceedingly broad and about as long as metacarpus; radius straight and perpendicular to anterior margin of stigma, longer than the first intercubitus; legs slender; posterior coxae nearly half as long as the thorax, and finely granular above; inner spur of middle tibiae shorter than middle metatarsus; inner spur of posterior tibiae half as long as posterior metatarsus; abdomen slender, a little shorter than the thorax; first dorsal abdominal plate distinctly narrowing to apex, at least twice as long as broad at base, smooth and polished on basal half, finely rugulose beyond; second dorsal abdominal plate long, very weakly roughened, rather shining, and provided with two longitudinal grooves medially; posteriorly the second tergite is decidedly emarginate; the membranous margins along the two basal plates very broad; third and following tergites smooth and shining; hypopygium not surpassing the last dorsal segment; ovipositor sheaths short. Black; palpi pale; antennae brownish-black; tegulae and wing-bases very pale yellow; wings hyaline; costa and base of stigma yellow; legs pale yellow, except the posterior coxae which are black, and the apex of posterior femora, base and apex of posterior tibiae, and more or less of posterior tarsi, which are dusky; abdomen black; the membranous margins along the first and second dorsal plates yellow; venter of abdomen yellowish on the basal half or two-thirds.

Male.—Essentially as in the female.

Type.—In the collection of Dr. C. T. Brues.

Type-locality.—Mount Constitution, Washington.

Allotype locality.—Moscow Mountain, Idaho.

Paratype localities.—Moscow Mountain, Idaho, and Vancouver, British Columbia.

Described from one female and three male specimens from the collection of Dr. C. T. Brues, at Harvard University. The type, allotype, and one of the paratypes are in Doctor Brues's collection; the other paratype is in the United States National Museum. I have also seen one specimen of this species in the Cornell University Collection, labeled "Goldstream to Downy Creek, Selkirk Mts., Br. Col., Aug. 7-11, '05"; and one in the collection of the Boston Society of Natural History, taken by Mr. C. W. Johnson, on Mount Washington, New Hampshire, at 3,000 feet.

2. MICROPLITIS RUGOSUS, new species.

Near *coloradensis*, but differs from that species in being somewhat more coarsely sculptured; in lacking the pronounced median facial carina that, in *coloradensis*, extends from the antennal fossae to the clypeus; in the bright testaceous posterior coxae and femora; and in more or less of the dorsum of the abdomen being reddish-testaceous.

Male.—Length 3.5 mm. Face very coarsely reguloso without a distinct median longitudinal carina; vertex, temples, and cheeks roughened like the face; mesoscutum coarsely ruguloso-punctate; the parapsidal furrows present but poorly defined; scutellum strongly rugulose and dull; mesopleurae ruguloso-punctate anteriorly and below the straight, distinctly crenulate, longitudinal furrow, polished above it; propodeum sloping gradually from base to apex, strongly rugoso-reticulate, and provided with a median longitudinal carina; stigma very short and broad, about as long as the metacarpus; radius very slightly directed outward, distinctly longer than first intercubitus; inner spur of middle tibiae a little shorter than middle metatarsus; posterior coxae less than half as long as the thorax; inner spur of posterior tibiae half as long as the posterior metatarsus; abdomen a little shorter than the thorax, depressed; first dorsal abdominal plate parallel-sided, about twice as long as broad, and ruguloso-striate; second abdominal tergite distinctly striate, and provided with a sharply-margined triangular shield medially, that is broadest at the base of the segment; posteriorly the second tergite is strongly emarginate; remainder of the abdomen smooth and shining. Black; antennae testaceous below, brownish above; tegulae and wing bases bright testaceous; wings hyaline; costa yellow; stigma entirely brown; legs, including all coxae and tarsi, testaceous; abdomen more or less reddish on the dorsum, especially on the second and third tergites; basal half of the venter of the abdomen testaceous.

Type locality.—Ashland, New Jersey.

Type.—In the collection Dr. C. T. Brues, at Harvard University.

Described from a single male specimen labeled "Ashland, N. J., 7-15-'06."

3. MICROPLITIS COLORADENSIS, new species.

Very close to *perplexus*, from which it differs in the head and thorax being much more coarsely roughened and dull; in the median area on the second abdominal plate being triangular; in the granular and opaque posterior coxae; and in the fore and middle coxae and the apex of the hind coxae being testaceous.

Male.—Length 3.8 mm. Face rugulose and opaque, with a polished median carina extending from the base of the antennae to the base of the clypeus; vertex, temples, and cheeks ruguloso-punctate and dull; mesoscutum opaque, the parapsidal grooves rather well indicated, broad, and rugulose, the lobes of the mesoscutum much more weakly roughened; scutellum convex, coarsely roughened and dull, mesopleurae ruguloso-punctate anteriorly and below the rather broad coarsely crenulate longitudinal furrow, highly polished above it; propodeum rugoso-reticulate, with a prominent median longitudinal carina; stigma broad, about as long as the metacarpus; radius straight, perpendicular to the anterior margin of the stigma and about twice as long as the first transverse cubitus; posterior coxae granular and opaque; inner spur of middle tibiae distinctly shorter than the middle metatarsus; inner spur of posterior tibiae half the length of the posterior metatarsus; abdomen a little shorter than thorax; first dorsal abdominal plate slightly broader at apex than at base and a little more than one and one-half times as long as broad at apex, finely rugulose, except in the middle at base; second abdominal tergite long, narrower at base than at apex, emarginate at apex, and provided with two longitudinal impressed lines medially, which converge posteriorly and enclose a smooth and shining triangular area; suture between second and third tergites not distinct medially; the areas on either side of the triangular median portion of the second tergite opaque and somewhat roughened; third and following tergites smooth and polished. Black; labrum, mandibles, and labial palpi blackish; maxillary palpi fuscous; antennae entirely black; tegulae and wing-bases testaceous; wings hyaline, very slightly fuliginous at apex, the veins and stigma brown; legs, including fore and middle coxae, testaceous; posterior coxae black on basal half, testaceous apically; posterior femora blackish on apical half above; posterior tibiae below and at apex, and the posterior tarsi, infuscated; abdomen entirely black.

Type locality.—Colorado.

Type.—Cat. No. 24001, U.S.N.M.

Described from three male specimens labeled "Colo. 2082, Collection C. F. Baker."

4. MICROPLITIS PERPLEXUS, new species.

Closely resembles *coloradensis*, but differs in having the mesoscutum and scutellum less coarsely roughened and more shining, in the posterior coxae being smooth and shining above, in the entirely polished second abdominal tergite, in the longer abdomen and the darker legs.

Female.—Length, 4 mm. Face finely ruguloso-punctate, and somewhat shining, with a distinct polished median carina extending from the base of antennae to base of clypeus; vertex, temples, and cheeks finely confluently punctate; mesoscutum finely ruguloso-punctate, shining; the parapsidal grooves broad, rather well indicated; scutellum slender, closely punctate and shining; mesopleurae punctate anteriorly and below, polished above, and provided with a longitudinal strongly crenulate furrow; propodeum coarsely rugose, with a median longitudinal carina; stigma broad and about as long as the metacarpus; radius perpendicular to anterior margin of stigma, much longer than first transverse cubitus; posterior coxae distinctly less than half as long as the thorax, entirely smooth and subpolished; inner spur of posterior tibiae half as long as the metatarsus; abdomen long and slender, at least as long as the thorax, with a rather pronounced ventral keel; the first dorsal plate narrow, parallel-sided, twice as long as broad, smooth and polished on basal half, finely striate on posterior half; second tergite long, much narrower at base than at apex, the sides oblique on basal half, parallel on the apical half, and provided with two parallel longitudinal grooves medially which enclose a slender median area; the second and following tergites entirely polished; ovipositor sheaths slightly exserted. Black; labrum reddish; palpi dusky; antennae entirely black; tegulae yellowish; wings hyaline, weakly infumated at apex; veins and stigma dark brown; legs reddish-testaceous; posterior tibiae and tarsi somewhat infuscated; abdomen entirely black; ovipositor sheaths black.

Type locality.—Indiana.

Type.—Cat. No. 24000, U.S.N.M.

Described from one female labeled "Ind. 2090, Collection C. F. Baker." I have seen another female specimen, in the collection of the Boston Society of Natural History, taken by Mr. C. W. Johnson, at Hampden, Maine; and three specimens in the Cornell University Collection: one from Carbonate, British Columbia (J. C. Bradley), and two from Waubamic, Ontario (H. S. Parish).

5. MICROPLITIS CARINATUS Ashmead.

Microplitis carinata ASHMEAD, Trans. London Ent. Soc., 1900, p. 293.

Type.—In the United States National Museum.

St. Vincent.

This species has the habitus and particular characters of an *Apanteles*, but because of the presence of the second intercubitus it must be retained in *Microplitis*. The propodeum, save for the median longitudinal carina, is perfectly smooth; the first dorsal abdominal plate is very long and narrow, parallel-sided, and truncate at apex; and the second plate is short, transverse, and partly aciculate.

The type is the only specimen of this species that I have seen.

6. MICROPLITIS KEWLEYI, new species.

Very similar to *confusus*, which species it also resembles in the cocoons and the type of host attacked. The adult differs from *confusus* in the first dorsal abdominal plate being distinctly a little broader at apex than at base; in the more weakly punctate and strongly shining mesoscutum and scutellum, and in the dorsum of the abdomen being wholly black.

Female.—Length 2.5 mm. Face closely minutely punctate, shining medially; clypeus weakly punctate and shining; vertex, temple and cheeks distinctly closely punctate; antennae much shorter than the body; mesoscutum with numerous irregular punctures, strongly shining; scutellum impunctate, polished on the disk; mesopleurae punctate and shining below and in front of the crenulate furrow, perfectly smooth and highly polished above it; propodeum coarsely rugoso-reticulate, with a prominent median longitudinal carina; metacarpus shorter than stigma; radius hardly as long as first intercubitus; legs slender; spurs of posterior tibiae about equal in length, and much less than half as long as metatarsus; abdomen almost as long as thorax; first dorsal abdominal plate broadening slightly posteriorly, distinctly broader at apex than at base, truncate at apex, mostly smooth and shining, having only a few very weak striae at the sides; remainder of dorsum of abdomen very highly polished; ovipositor subexserted; the hypopygium not surpassing apex of last dorsal segment. Black; labrum brown; antennae often testaceous beneath on the basal two-thirds, brown on the apical third; tegulae pale; wing-bases darker; wings subhyaline, the veins and stigma light brown, the latter yellowish and transparent on basal third; legs yellowish-brown; posterior coxae black; abdomen piceous black; the membranous margins along the two basal plates dingy ferruginous.

Male.—Like the female, except for the usual secondary sexual differences.

Cocoons.—3.2 mm. in length; cylindrical; plain, without longitudinal ridges; pale dirty brownish; gregarious.

Type locality.—College Park, Maryland.

Type.—Cat. No. 23998, U.S.N.M.

Hosts.—"Cutworms;" *Euxoa*, species.

Described from eighteen female and two male specimens reared from a cutworm by R. J. Kewley, in the Bureau of Entomology, under Cage No. B86G, at College Park, Maryland. In addition to the type series the National Collection contains many specimens, for the most part reared from cutworms, from the following localities: College

Park, Maryland (R. J. Kewley and J. Feighenne); Trout Lake, Wisconsin (J. J. Davis), Muscatine, Iowa (D. M. Wadley). One specimen is from Battle Creek, Michigan, reared from *Euxoa*, species by Mr. Satterthwaite, under Webster No. 13498, June 22, 1914. There are also two collected specimens, one from Canada, and one from Washington, District of Columbia. Doctor Brues's collection, at Harvard University, contains two specimens, collected by A. L. Melander, at Geneva, New York; and the Cornell Collection has one specimen taken at Ithaca, New York, by F. W. Petty.

7. MICROPLITIS CRENULATUS (Provancher).

Microgaster crenulatus PROVANCHER, Addit. Faun. Canad. Hymen., 1888, p. 387.

Type.—In the Museum of Public Instruction, at Quebec.

Canada; Massachusetts.

This species is very similar to *mamestrae*, but I believe it to be distinct. It can be readily separated from that species by the characters noted in the key.

I have seen only two specimens: one, in the National Collection, without locality data, but with the note, "cocoon found on base of water lily;" and one, in Doctor Brues's collection, taken at Manomet, Massachusetts, by J. A. Cushman.

8. MICROPLITIS MAMESTRAE Weed.

Microplitis mamestrae WEED, Bull. Ill. State Lab. Nat. Hist., No. 3, 1887, p. 2.

Type.—Probably in the Illinois State Laboratory of Natural History.

Illinois; New York; Michigan; Ohio; Massachusetts; New Jersey.

Host.—*Mamestra picta* Harris.

Cocoon.—Solitary; reddish-brown; angular; 5 mm. in length.

Although I have not seen the type, the species is so distinct, and so well characterized in the original description, that it cannot be confused. The peculiar cocoon, characteristic of this species, is also well described by Weed.

The parapsidal furrows are fine, but distinct; scutellum long, longer than broad at base; stigma with a large pale spot at base; all coxae testaceous; abdomen broad, black above; the first tergite long, usually at least twice as long as its greatest breadth, normally very slightly broader at apex than at extreme base.

The National Collection contains material from the following localities: Albany, New York (J. A. Lintner, from *Mamestra picta*); Illinois (S. A. Forbes); Agricultural College, Michigan (C. F. Baker); Columbus, Ohio; West Springfield, Massachusetts (H. E.

Smith). Doctor Brues's collection has one specimen from Trenton, New Jersey; that of Cornell University, one from Dryden, New York, and one from Caroline-Hartford, New York. At the Gipsy Moth Laboratory, Melrose Highlands, Massachusetts, there are four specimens reared by R. T. Webber, from *Mamestra picta*, under Gipsy Moth Laboratory No. 12123; the host larvae were taken at Melrose Highlands, Lynnfield, and Acton, Massachusetts.

9. MICROPLITIS QUADRIDENTATUS (Provancher).

Microgaster quadridentatus PROVANCHER, Addit. Faun. Canad. Hymen., 1886, p. 140.

Microplitis terminatus WEED, Trans. Amer. Ent. Soc., vol. 15, 1888, p. 295.

Type.—In the Museum of Public Instruction, at Quebec; that of *terminatus* is in the Philadelphia Academy of Natural Sciences.

Canada; Illinois; Massachusetts; New Hampshire; Maine, New York.

Host.—*Arsilonche albovenosa* Goeze.

Cocoons.—4.5 mm. long; broad; not fluted; pale grayish-brown in color; and provided with some loose silk at the sides.

This species is a very well-marked one, not easily confused with any other known species. It is sufficiently well characterized in the table to species.

Besides the four specimens constituting the type series of *terminatus*, which are in the Philadelphia Academy of Sciences, I have seen the following material: in the United States National Museum, specimens from Franconia, New Hampshire (Mrs. A. T. Slosson); "Maine"; Canada (C. F. Baker), and two specimens without locality data; in the Cornell University Collection, one specimen from Ithaca, New York; one from Laval County, Quebec, and one from Montreal, Canada; in Doctor Brues's collection, two specimens from Essex County, Massachusetts.

10. MICROPLITIS ALASKENSIS Ashmead.

Microplitis alaskensis ASHMEAD, Proc. Wash. Acad. Sci., vol. 4, 1902, p. 249.

Type.—In the United States National Museum.

Alaska; Washington; Oregon; Colorado; California; Montana; Kansas; Illinois; Massachusetts; New York; British Columbia, Ontario, and Nova Scotia, Canada.

Host.—*Hadena procincta* Grote; *Plusia*, species.

Cocoons.—4.5 mm. in length; ribbed; tapering strongly toward one end, less so toward the other; greenish in color; apparently solitary.

The characters noted in the table to species will suffice for distinguishing this widely distributed form from related species.

Besides the type, from Juneau, Alaska, the National Collection contains many specimens from diverse localities: from Pullman, Washington (J. A. Hyslop, reared from *Plusia*, species, in the Bureau of Entomology, under Webster Nos. 4595 and 5903); Mount Hood, Oregon; Colorado (C. F. Baker); Los Angeles, California; Santa Cruz Mountains, California; Champaign, Illinois; Boston, Massachusetts; Vancouver, British Columbia (reared from *Hadena procincta* Grote by J. M. Langston). The collection of the Boston Society of Natural History has one specimen from S. W. Harbor, Maine; Doctor Brues's collection contains specimens from Wathena, Kansas (W. M. Mann); Pullman, Washington (A. L. Melander); Florissant, Colorado (S. A. Rohwer); Lake McDonald, Glacier Park, Montana (A. L. Melander); and in the Cornell University Collection there is material from Ithaca, New York; Waubamic, Ontario (H. S. Parish); Truro, Nova Scotia; Carbonate and Downie Creek, British Columbia, Canada (J. C. Bradley).

11. MICROPLITIS AUTOGRAPHAE, new species.

Resembles *alaskensis* in size and color and general appearance, but differs from that species in the unicolorous stigma, in the perfectly smooth and polished second abdominal tergite, and in the relatively shorter and broader abdomen. The cocoons of the two species also are very similar, but they differ in color, those of *alaskensis* being pale green, while those of the present species are light brown.

Female.—Length, 3.5 mm. Head transverse; face closely coarsely punctate and dull; clypeus more feebly punctured, somewhat shining; vertex temples and cheeks punctate and dull, although less so than the face; mesoscutum and scutellum strongly shining, indistinctly punctate; the parapsidal furrows, which are well-marked, and the broad depression posteriorly on the mesoscutum, irregularly roughened but shining; a distinct median carina on the mesoscutum posteriorly; mesopleurae punctate and dull anteriorly and below, smooth and polished above, and provided with a longitudinal slightly curved crenate furrow; propodeum very coarsely reticulated, with a prominent median longitudinal carina; the stigma large; the radius no longer than the first transverse cubitus, the second cubital cell being large; legs slender, spurs of posterior tibiae about equal in length, distinctly less than half as long as the metatarsus; abdomen narrow at base, broad posteriorly; the first dorsal abdominal plate broadening slightly behind, a little more than one and one-half times as long as broad at apex, finely rugulose, with a longitudinal groove medially on the basal two-thirds; remainder of the dorsum of the abdomen highly polished; ovipositor very slightly exserted; hypopygium not attaining the apex of the abdomen. Black; clypeus, labrum, and basal segment of labial palpi, black; antennae entirely and the tegulae and wing-bases black; wings slightly fuliginous, the veins and entire stigma dark brown; all coxae and basal segment of all trochanters black; remainder of the legs testaceous, except the tarsi, which are more or less dusky; abdomen entirely black, except the membranous margins along the first dorsal plate, which are brown.

Male.—Essentially as in the female.

Cocoons.—5 mm. long; leathery, elliptical, tapering strongly toward both ends, and provided with a number of fine striations; color light brown.

Type locality.—Maxwell, New Mexico.

Type.—Cat. No. 24002, U.S.N.M.

Described from three female and one male specimens, reared by D. J. Caffrey, June 4, 1915, from *Autographa californica* Speyer, in the Bureau of Entomology, under Webster No. 11135.

12. MICROPLITIS HYPHANTRIAE Ashmead.

Microplitis hyphantriae ASHMEAD, Proc. Ent. Soc. Wash., vol. 4, 1898 (1897), p. 164.

Type.—In the United States National Museum.

Illinois; Massachusetts; Arkansas; Texas; Missouri; Michigan; Maryland; Ohio; New York; Indiana; Ontario; Canada.

Hosts.—*Hyphantria cunea* Drury; *Xylina*, species; *Apatela furcifera* Guenée; *Acronycta hasta* Guenée.

Cocoon.—3.5 mm. long, brownish, not ribbed, apparently solitary.

The species is exceedingly close to *ceratomiae*, but can be satisfactorily distinguished by use of the group of characters given in the foregoing table.

In addition to the type series the National Collection has the following material: One reared from *Xylina*, species, by D. Isley, at Bentonville, Arkansas, under Quaintance No. 16336; one from Texas, from the Belfrage Collection; one reared from a noctuid larva in Missouri; one reared from *Apatela furcifera* at Sullivan, Indiana, in the Bureau of Entomology, under No. 143 L^0; and collected specimens from Maryland; Wooster, Ohio; Canada, and Michigan (C. F. Baker), and Algonquin, Illinois. The Cornell University Collection has several specimens from Chicopee, Massachusetts; Waubamic, Ontario, Canada (H. S. Parish); and Ithaca, New York. I have also seen one specimen from the collection of the American Museum of Natural History, reared from *Acronycta hasta*, by J. A. Grossbeck. The collection of the Gipsy Moth Laboratory, at Melrose Highlands, Massachusetts, has one specimen from Tewksbury, Massachusetts.

13. MICROPLITIS CERATOMIAE Riley.

Microplitis ceratomiae, RILEY, Trans. St. Louis Acad. Sci., vol. 4, 1881, p. 303.

Microplitis waldeni VIERECK, Bull. 22. Conn. State Geol. and Nat. Hist. Survey, 1917 (1916), pp. 203, 204.

Type.—In the United States National Museum; type of *waldeni* is in the Connecticut State Agricultural Experiment Station, at New Haven.

Missouri; Connecticut; Massachusetts; Maine; New York; Colorado; Michigan; Canada.

Hosts.—*Ceratomia amyntor* Geyer; *Paonias excaecatus* Smith and Abbot; *Sphinx drupiferarum* Smith and Abbot; *Sphinx gordius* Stoll. Apparently a general parasite on the larvae of Sphingidae, issuing when the hosts are nearly full grown.

Cocoons.—About 3.5–4 mm. in length; brown; with several longitudinal ribs; gregarious, more or less cemented together.

After studying the type of *waldeni*, I find it to agree perfectly with *ceratomiae*. As noted under *hyphantriae*, *ceratomiae* is closely allied to that species, and is sometimes separated with difficulty.

The National Collection contains, in addition to the types of *ceratomiae*, numerous specimens from the following localities: Springfield, Massachusetts; Agricultural College, Michigan; Ottawa, Canada (reared from *Ceratomia amyntor* by Fletcher); Lincolnville, Maine (reared from *Sphinx gordius*, by H. G. Dyar); New Hampshire; Michigan and Colorado (C. F. Baker). In Dr. Brues's collection I have seen a series of specimens of this species reared from a sphingid larva taken at Forest Hills, Massachusetts; also three specimens taken at Machias, Maine, by Mr. C. W. Johnson. The collection at Cornell University contains specimens from Wilmington, New York; and Truro, Nova Scotia (R. Matheson); and that of the Boston Society of Natural History, one specimen from Bar Harbor, Maine.

14. MICROPLITIS CROCEIPES (Cresson).

Microgaster croceipes CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 183.
Microplitis nigripennis ASHMEAD, Bull. 50, U. S. Dep. Agr., Bur. Ent., 1905, p. 122, fig. 23.

Type.—In the United States National Museum. Location of types of *nigripennis* unknown.

Texas; Alabama; Mississippi; Arkansas; New Mexico; Colorado; Kansas; Tennessee; Virginia; Illinois; New Jersey.

Hosts.—*Heliothis obsoleta* Fabricius; *Chloridea virescens* Fabricius.

Cocoons.—6 mm. in length; cylindrical; pale brownish; longitudinally ribbed; solitary.

A large, very shining species; head and mesonotum with exceedingly minute, setiform punctures; wings strongly infumated; posterior femora short and stout; abdomen wholly smooth and shining.

In addition to the types of *croceipes* there are many specimens in the National Collection from various localities: from Virginia; Southern Illinois (Robertson); Mesilla, Lone Mountain, and Las Cruces, New Mexico (Cockerell); Colorado (C. F. Baker); Wellington, Kansas (reared from *Heliothis*, species, by W. E. Pennington and H. T. Osborn, under Webster No. 5458); Knoxville, Tennessee (reared by C. C. Hill, from *Heliothis obsoleta*, under Webster No. 9136); Brownsville, Texas (reared from *H. obsoleta*, by R. A. Vickery, under Webster No. 6437); Clarksville, Tennessee (reared from *Chloridea virescens*, by F. C. Liles). The Cornell Collection has two specimens from Palisades, New Jersey.

15. MICROPLITIS LONGICAUDUS, new species.

Nearest *croceipes*, with which it agrees in the smooth, almost impunctate head and mesoscutum, in the short and stout posterior femora, and the slightly bulging posterior orbits; it differs from that species in its hyaline wings and longer ovipositor.

Female.—Length 3.8 mm. Head with the face distinctly though very shallowly punctate, rather shining, the clypeus impunctate and polished; vertex, temples, and cheeks practically impunctate, subpolished; the temples bulging slightly beyond the line of the eyes; antennae much shorter than the body; mesoscutum virtually impunctate, subpolished, pubescent; scutellum with indistinct setigerous punctures, shining; mesopleurae with a sharply marked, curved longitudinal crenulate furrow, mostly polished, minutely indistinctly punctate below the furrow and anteriorly; propodeum coarsely rugose, with a prominent median longitudinal carina; fore wing with the radius directed outward, very slightly longer than the transverse cubitus; stigma longer than the metacarpus; posterior femora very short and stout, less than two and one-half times as long as their greatest breadth; posterior tibial spurs short, subequal, decidedly shorter than half the metatarsus; last segment of posterior tarsi twice as long as the preceding segment; abdomen as long as the thorax, rather stout; the first dorsal plate parallel-sided, apex and base of equal breadth, more than twice as long as broad, and mostly smooth and polished; the membranous margins rather broad along apical third of first plate; remainder of the abdomen polished; hypopygium large, prominent, very slightly surpassing the apex of the last dorsal segment; ovipositor sheaths truncate at apex, projecting nearly half the length of the abdomen. Black; clypeus reddish; palpi pale; antennae wholly black; tegulae and wing-bases black; wings hyaline, with an indistinct infumated patch just below stigma; veins yellowish-brown; stigma dark brown, with a large pale spot at base; legs, except the black coxae and basal segment of trochanters, dark testaceous; abdomen black, except the membranous margins along the first dorsal plate, which are pale; ovipositor sheaths black.

Type locality.—Colorado.

Type.—Cat. No. 23997, U.S.N.M.

Described from one female specimen labeled, "Colo. 1414. Collection C. F. Baker."

16. MICROPLITIS GORTYNAE Riley.

Microplitis gortynae Riley, Trans. St. Louis Acad. Sci., vol. 4, 1881, p. 304.

Type.—In the United States National Museum.

Iowa, Missouri, New York, Virginia, Colorado.

Hosts.—*Achatodes zeae* Harris; *Hydroecia immanis* Grote; *Papaipema nebris* Guenée.

Cocoons.—Reddish-brown; longitudinally ribbed, the ribs lighter in color; gregarious, held together in irregular masses.

A very small, smooth and shining species, with an unusually small, flat, and smooth scutellum; antennae short; body black, except the membranous margins along the two basal abdominal plates.

The National Collection contains, besides the types, eight specimens reared by Miss Mary E. Murtfeldt, at Kirkwood, Missouri, from *Achatodes zeae;* two specimens reared at Waterville, New York, from *Hydroecia immanis*, by I. M. Hawley; a large series, from Rye, New York, reared by H. Bird, from *Papaipema nebris*, and collected specimens from Colorado, and Arlington, Virginia.

17. MICROPLITIS NIGRITUS, new species.

Closely related to *croceipes*, from which it differs in the subhyaline wings, and in the much more slender and black posterior femora.

Female.—Length 4 mm.; face minutely, closely punctate and somewhat opaque; the front, vertex and temples, practically impunctate, subpolished, the temples bulging distinctly a little beyond the line of the eyes; antennae much shorter than the body; mesoscutum smooth and very strongly shining, with only very shallow, exceedingly minute punctures; mesopleurae mostly polished, having only a small punctate area anteriorly, and provided with a long curved longitudinal crenulate furrow; propodeum rugoso-recticulate, with a prominent median longitudinal carina; stigma a little longer than the metacarpus; radius arising slightly before the middle of the stigma and strongly directed outward, no longer than the 1st transverse cubitus; posterior coxae very short; the posterior femora slender; spurs of posterior tibiae a little shorter than half the metatarsus; abdomen at least as long as the thorax, rather slender; the 1st dorsal abdominal plate narrow, parallel-sided, nearly three times as long as broad, base and apex apparently of equal breadth, smooth and polished medially with indistinct roughening at the sides; 2d tergite, like the following segments, smooth and polished; hypopygium not surpassing the apex of the abdomen; ovipositor sheaths about one-fifth as long as the abdomen. Black; mouth parts, including the palpi, piceous; antennae and the tegulae black; wings subhyaline, veins and stigma brown, the latter with an indistinctly paler spot at base; all coxae, basal third of fore femora, and basal two-thirds of middle and posterior femora, black; posterior tibiae testaceous, with a narrow annulus near base and the apical third, dusky; abdomen wholly black, except the membranous margins along the 1st tergite which are dark reddish-brown.

Male.—Differs from the female only in the much longer antennae, the shorter abdomen, and the entirely black posterior femora.

Type locality.—Colorado.

Type.—Cat. No. 24003, U.S.N.M.

Described from 1 female specimen labeled "Colo. 1080, Collection C. F. Baker," and 4 male specimens from the Baker Collection, bearing the following numbers: Colo. 2076 (2 specimens); Colo. 1330; and Colo. 1329.

18. MICROPLITIS MELIANAE Viereck.

Microplitis melianae VIERECK, Proc. U. S. Nat. Mus., vol. 40, 1911, p. 185.

Type.—In the United States National Museum.

Iowa; Kansas; Illinois; Tennessee; New York; Canada.

Hosts.—*Meliana albilinea* Hübner (Viereck); *Cirphis unipuncta* Haworth.

Cocoons.—About 3.5 mm. long; brown; not ribbed; evidently gregarious, but not cemented together.

This species, while very close to *brassicae*, can be separated from that species by the characters noted in the key.

Besides the types, there is in the National Collection material from the following localities: Riley County, Kansas; Long Island, New York; Champaign, Illinois; Douglas County, Kansas; Nashville, Tennessee (C. C. Hill); and a specimen, without locality data, reared from *Cirphis unipuncta.* Doctor Brues's collection has a single specimen from Chicago, Illinois; and in the Cornell University collection there are two specimens, from Caroline-Hartford, and Axton, New York.

19. MICROPLITIS BRASSICAE, new species.

Very closely resembles *melianae;* but it can be readily distinguished from that species by the longer stigma, which is also more contrastingly pale on the basal third; the posterior tibiae are slightly dusky at extreme base in *brassicae*, not so in *melianae;* also the head is more coarsely punctate and opaque in the latter.

Female.—Length 2.7 mm. Face, vertex and temples very minutely punctate, somewhat shining; antennae as long as the body; mesoscutum and scutellum shallowly punctate and opaque, the latter decidedly convex; mesopleurae finely punctate and dull, with rather long, thick pubescence anteriorly and below the longitudinal crenulate furrow, impunctate and highly polished above; propodeum rugose, with a median longitudinal carina; stigma large, distinctly longer than the metacarpus, and decidedly more than twice as long as its greatest breadth; radius strongly directed outward, hardly longer than the first intercubitus; legs slender; the posterior coxae very short; spurs of posterior tibiae much less than half as long as the metatarsus; abdomen ovate, depressed, narrow at base, very broad on the third tergite; first dorsal abdominal plate slender, distinctly broader at base than at apex, and more than three times as long as broad at apex, wholly smooth and polished; second dorsal plate rather triangular, narrow at base, but near the apex broadening suddenly to the lateral margins of the abdomen, and like the following tergites, smooth and polished; membranous margins along the first and second plates very broad; hypopygium not reaching apex of abdomen; ovipositor subexserted. Black; palpi yellow; clypeus and mandibles brownish-black; antennae entirely black; tegulae testaceous; wings rather whitish-hyaline; veins and stigma brown, the latter with a very large pale spot in the membrane at base; legs testaceous, except all coxae, which are black, and the extreme apex of posterior femora, the base and apex of posterior tibiae, and all the tarsi, which are more or less fuscous; abdomen mostly deep reddish-black on the basal half, black beyond.

Male.—Like the female, except that the tegulae usually are blackish.

Type locality.—Rocky Ford, Colorado.

Type.—Cat. No. 24004, U.S.N.M.

Host.—*Autographa brassicae* Speyer.

Described from three female and one male specimens reared by H. O. Marsh, from August 17 to September 3, 1914, under Chittenden No. 953.

Besides the type series the National Collection contains the following material: one specimen reared from the same host as the type series, at Brownsville, Texas, by R. A. Vickery, under Webster No. 6458; one specimen labeled "Las Cruces, N. Mex., June 25, 1895, Cockerell;" one from Southern California; and one from Arizona (C. F. Baker).

20. MICROPLITIS PLUTELLAE, new species.

Somewhat resembles *melinae*; but differs in its smaller size, unicolorous stigma, darker legs, and the more prominent ovipositor.

Female.—Length 2.2 mm. Face a little longer and narrower than usual in this genus, and together with the vertex, temples, and cheeks, finely punctate and opaque; antennae about as long as the body; mesoscutum and scutellum closely punctate and dull; mesopleurae punctate and dull anteriorly and below the finely crenulate longitudinal furrow, highly polished above it; propodeum coarsely rugose, with a distinct median longitudinal carina, rather shining; stigma long, distinctly longer than the metacarpus; radius short, apparently a little shorter than the first intercubitus, and shorter than the stigma is broad; posterior coxae smooth and shining; posterior femora slender; spurs of posterior tibiae much less than half as long as the metatarsus; abdomen depressed, ovate, a little shorter than the thorax, and broadest at the base of the third segment; the first dorsal abdominal plate slender, narrowing gradually posteriorly, distinctly narrower at apex than at base, smooth and very shining, somewhat polished medially; second dorsal abdominal plate narrow on basal half, broadening suddenly to the lateral margins of the abdomen in the middle of the segment; the membranous margins along the first and the basal half of the second abdominal plates very broad; second and following tergites smooth and polished; hypopygium prominent but not surpassing the apex of the last dorsal abdominal segment; ovipositor sheaths slender, strongly shining, projecting nearly one-fourth the length of the abdomen. Black; palpi dusky at base, labrum and mandibles dark brown; clypeus black; antennae, tegulae and wing-bases black; wings hyaline, the veins, and the stigma entirely, brown; all coxae and trochanters, basal third of fore femora, basal two-thirds of the middle femora, and the posterior femora entirely, black or blackish; tibiae testaceous, but more or less infuscated on the outer side and at apex; tarsi fuscous; abdomen black; the lateral membranous margins on the two basal plates blackish; hypopygium dark brown; ovipositor sheaths brownish-black.

Male.—Essentially as in the female.

Cocoon.—2.5 mm. long; smooth, brown, covered with a very little loose silk; apparently solitary.

Type locality.—Rocky Ford, Colorado.

Type.—Cat. No. 24006, U.S.N.M.

Host.—*Plutella maculipennis* Curtis.

Described from four females and one male, reared from the above host, June 22 to July 18, 1916, at Rocky Ford, Colorado, by H. O. Marsh, under Chittenden No. 1584.

There are in the United States National Museum four other specimens of this species, from Los Angeles County, California, reared from the same host, and one specimen from the C. F. Baker Collection, labeled "Colo. 1228."

21. MICROPLITIS COACTUS Lundbeck.

Microplitis coactus LUNDBECK, Vid. Medd. naturh. Foren Kjobenhavn, 1896, p. 243.

Type.—I am not sure of the location of the type of this species. It is probably in some European collection.

Greenland.

***Host*—*Noctua*,** species.

A small species, apparently very similar to *plutellae*, from which it can be separated by the characters listed in the key. Mesoscutum and scutellum punctate; tegulae brown; wings hyaline, veins and stigma brown, the latter pale at base; coxae, the base of fore and middle femora, and posterior femora almost entirely, blackish; abdomen black, smooth, shining; the first tergite slender, and narrowest at apex.

Cocoon.—"Pale grayish-brown, oblong, cylindrical, woolly, 4 mm. in length."

I have seen no specimens of this species. The above notes are taken from the original description.

22. MICROPLITIS QUINTILIS Viereck.

Microplitis quintilis VIERECK, Bull. 22, Conn. State Geol. and Nat. Hist. Survey, 1917 (1916), p. 204.

Type.—In the Connecticut Agricultural Experiment Station, in New Haven, Connecticut.

Very similar to *feltiae*, but has scutellum less coarsely roughened; the tegulae are brown; and the first tergite does not narrow so gradually posteriorly. Vertex and temples closely punctate and dull; mesoscutum very dull, and closely punctate in the region where parapsidal grooves would be if present; wings very slightly fuliginous; radius no longer than first intercubitus; stigma wholly brown, without a pale spot at base; all coxae and basal trochanters black; apex of posterior femora and tibiae, and the posterior tarsi dusky; abdomen shorter than thorax; first dorsal abdominal plate slender, narrowing abruptly near apex; this plate is very minutely striate at the sides; remainder of abdomen smooth and shining; venter of abdomen, as well as the dorsum, black.

Known only from the unique male type, from which the above notes were made.

23. MICROGASTER FELTIAE, new species.

Related to *plutellae*, but is at once distinguished by its somewhat larger size, by the paler legs and tegulae, and the slightly infumated wings.

Male.—Length, 2.8 mm. Face, vertex, temples and cheeks strongly closely punctate and opaque; antennae longer than the body; mesoscutum confluently punctate and opaque, without parapsidal grooves; scutellum with separate, distinct punctures, rather flat; mesopleurae coarsely confluently punctate anteriorly and below the longitudinal crenulate furrow, smooth and polished above it; propodeum coarsely rugoso-reticulate, with a prominent median longitudinal carina; stigma a little longer than metacarpus; radius hardly as long as first intercubitus, and strongly directed outward; legs slender; inner spur of posterior tibiae a little longer than the outer, but less than half as long as the metatarsus; abdomen shorter than the thorax, ovate, depressed; first dorsal abdominal plate slender, decidedly narrower at apex than at base, and more than three times as long as broad at apex, mostly smooth and shining; second abdominal tergite broad, and like the following, smooth and polished; membranous margins along the first plate and the extreme base of the second, very broad. Black; basal segments of both labial and maxillary palpi dusky, the remainder yellowish; mandibles reddish-brown; labrum testaceous; tegulae testaceous; the wing-bases spotted with blackish; wings very slightly infumated, the veins and stigma brown, the latter with an indistinctly paler spot at base; fore and middle coxae brown; posterior coxae blackish; remainder of legs yellowish-brown, the fore and middle femora at base, and the posterior femora along the upper edge infuscated; the middle and posterior tibiae and all the tarsi more or less infuscated; abdomen black above and below; the membranous margins along the basal plates brown.

Cocoons.—4 mm. long; cylindrical; pergamentaceous; not ribbed; light brown in color; solitary.

Type locality.—Nashville, Tennessee.

Paratype locality.—Brownsville, Texas.

Type.—Cat. No. 24005, U.S.N.M.

Hosts.—*Feltia gladiaria* Morrison; *F. annexa* Treitschke; cutworm.

Described from two male specimens: one (type) reared from *Feltia gladiaria*, May, 1913, at Nashville, Tennessee, by C. C. Hill, under Webster No. 12398; the other (paratype) reared from *F. annexa* at Brownsville, Texas, on June 18, 1914, by R. A. Vickery, under Webster No. 5751.

In addition to the type specimens there is in the National Collection the following material of this species: one specimen reared from a cutworm, at Lafayette, Indiana, May 30, 1917, by J. J. Davis; four from Victoria, Texas, J. D. Mitchell, Collector; many specimens from the C. F. Baker Collection, bearing the state labels: Colorado; Arizona; Alabama; Kansas; Louisiana. I have also seen two specimens in Doctor Brues's collection, one from Pullman, Washington, and one from Lake Waha, Idaho.

24. MICROPLITIS LATISTIGMUS, new species.

Close to *striatus*, from which it differs, however, in possessing a distinct crenulate mesopleural furrow; in the longer antennae; in the head being only weakly punctate and shining; and in the smooth and polished third abdominal tergite.

Female.—Length 3 mm. Face, including clypeus, very shallowly punctate and shining; vertex smooth, polished; temples and cheeks very weakly punctate and shining; antennae very long, considerably longer than the body; mesoscutum and scutellum entirely closely deeply punctate and opaque; parapsidal grooves wanting; scutellum apparently about as broad at base as long down the middle and decidedly convex; mesopleurae closely punctate and dull anteriorly and below the broad, coarsely crenulate longitudinal furrow, mostly smooth and highly polished above it; propodeum coarsely reticulate, with a prominent median longitudinal carina; stigma about as long as metacarpus, and very broad; radius perpendicular to anterior margin of the stigma, and much longer than the first intercubitus; posterior coxae smooth; their femora stout; spurs of posterior tibiae nearly equal in length, and about one-third as long as the metatarsus; abdomen a little shorter than the thorax; first dorsal abdominal plate long, broadest at base, narrowing very strongly toward apex, where is is hardly half as broad as at base, mostly finely rugulose and opaque; second plate well defined, triangular, as broad at base as first plate is broad at apex, twice as long down the middle and four times as broad at apex as broad at base, very weakly striate posteriorly in the middle, and somewhat embossed medially; the following tergites smooth and polished; hypopygium extending a little beyond the apex of the last dorsal abdominal segment; ovipositor sheaths projecting slightly. Black; face entirely black; mandibles honey-yellow, except at tips; palpi pale stramineous; scape and pedicel of antennae mostly testaceous, the flagellum brownish-black; tegulae and wing bases yellow; wings hyaline; the veins and the stigma entirely dark brown; legs honey-yellow, except the posterior coxae, which are dark reddish-brown on the basal two-thirds, and the posterior tibiae and tarsi, which are practically entirely fuscous; dorsum of the abdomen black, except the broad membranous margins along the two basal plates, which are very pale yellow; venter of abdomen pale on the basal half, black beyond.

Cocoon.—4 mm. in length; cylindrical; bright reddish-brown; not ribbed; provided with a very little loose silk; apparently solitary.

Type locality.—Hagerstown, Maryland.

Type.—Cat. No. 24007, U.S.N.M.

Host.—"Lepidopterous larva."

Described from a single specimen reared by W. E. Pennington, at Hagerstown, Maryland.

25. MICROPLITIS STRIATUS, new species.

Distinguished at once from nearly all species of this genus by the absence of the longitudinal mesopleural furrow.

Male.—Length, 2.2 mm. Face, vertex, and temples closely sharply punctate and opaque; antennae missing beyond the eleventh segment, but apparently of normal length; mesoscutum and scutellum very coarsely confluently punctate and dull; the scutellum convex; mesopleurae closely coarsely punctate anteriorly and below the non-crenulate longitudinal depression, smooth and highly polished above it; propodeum short, rather flat, rugulose, with a distinct median longitudinal carina; stigma and metacarpus of about equal length; radius perpendicular to anterior margin of stigma and much longer than first intercubitus; posterior femora rather large; inner spur of posterior tibiae a little longer than the outer and very nearly half as long as the metatarsus; abdomen shorter than the thorax; first dorsal abdominal plate broadest at base, narrowing strongly toward apex, where it is hardly half as broad as at base, about twice as long as broad at base, and finely rugulose and opaque; second dorsal plate triangular, as broad at base as first plate is broad at apex, twice as long down the middle and four times as broad at apex as broad at base, opaque, minutely granular on basal half, finely striate on the apical half; third tergite opaque and indistinctly alutaceous; remainder of dorsum of abdomen smooth and shining. Reddish-black; head, including antennae, reddish; thorax black, more or less dark reddish on the sides and on propodeum; tegulae testaceous; wings hyaline, veins and stigma yellowish to pale yellowish-brown; fore and middle legs pale testaceous, except extreme base of coxae, which is blackish; posterior coxae largely reddish-black; posterior femora, tibiae and tarsi deep reddish-testaceous, more or less infuscated; abdomen black, more or less tinged with dark red, especially the first and second tergites; the broad membranous margins along the two basal plates pale yellow; venter pale at extreme base, black beyond.

Type locality.—Texas.

Type.—Cat. No. 24008, U.S.N.M.

Host.—Unknown.

Described from one specimen labeled, "Texas, Belfrage." I have also seen one specimen in Doctor Brues's collection at Harvard University, from Austin, Texas.

26. MICROPLITIS VARICOLOR Viereck.

Microplitis varicolor VIERECK, Bull. 22, Conn. State Geol. and Nat. Hist. Survey, 1917 (1916), pp. 203, 204.

Type.—In the Connecticut Agricultural Experiment Station at New Haven.

Connecticut; Tennessee; Texas; Pennsylvania; Louisiana; District of Columbia; Michigan; Illinois; Alabama; New York; South Carolina; Canada.

Hosts.—*Cirphis unipuncta* Haworth; *Plathypena scabra* Fabricius.

The following notes, based upon the unique type, are given because the original description of the species consisted merely of the characterization in the key: Length, 2.3 mm. Face and vertex closely punctate and dull; mesoscutum and scutellum uniformly closely punctate and opaque, the former only a little shining on the posterior angles; entire thorax rather strongly pilose; mesopleurae dull and punctate anteriorly and below, polished above; propodeum coarsely rugose, with a prominent median longitudinal carina; metacarpus as long as the stigma; radius hardly as long as first intercubitus; posterior coxae very short; spurs of posterior tibiae much less than half as long as metatarsus; abdomen shorter than thorax, slender at base, broad on the third tergite; first dorsal abdominal plate slender, narrowing strongly to apex, where it is much narrower than at base, coarsely punctato-rugulose, except the extreme apex, which is elevated and highly polished; second dorsal abdominal plate triangular, as broad at base as first plate is broad at apex, broadening to the lateral margins of abdomen posteriorly; second and following tergites smooth and polished. Black; antennae dark testaceous, the scape and pedicel paler; tegulae and wing-bases pale yellow; legs entirely yellow, except extreme base of posterior coxae, which is black, and the posterior tarsi, which are dusky; abdomen black, except the second and third tergites, which are testaceous, and the membranous margins along the first and second plates, which are pale yellow; venter of abdomen mostly yellow.

Besides the type, I have seen the following material of this species: In the National Collection there are five specimens, reared from *Cirphis unipuncta* by G. G. Ainslie, at Nashville, Tennessee, under Webster No. 11332C; five reared from "*Heliophila*, species" by R. A. Vickery, at Brownsville, Texas, under Webster Nos. 6451 and 6453; one specimen reared from *Cirphis*, at Schenectady, New York, by E. W. Searls; two reared by R. J. Kewley, at Columbia, South Carolina, from *Plathypena scabra;* one from the same host, reared at Nashville, Tennessee, by C. C. Hill; and collected specimens from Agricultural College, Michigan; Champaign, Illinois; Huntsville, Alabama; Washington, District of Columbia; Pennsylvania; Louisiana; and Canada. The Cornell Collection contains specimens from Caroline, Slaterville, Rock City, and Peru, New York; and Montreal, Canada.

27. MICROPLITIS SCUTELLATUS, new species.

Closely allied to *montanus;* but differs strikingly in the black tegulae, coxae and trochanters, in the wings being very slightly infumated, in the inner spur of posterior tibiae being distinctly a little shorter than the outer, and in having the disk of scutellum curiously pitted along the sides.

Female.—Length 3 mm. Head transverse; face, vertex and temples closely punctate and opaque; the face with a short median polished ridge just below the insertion of antennae; antennae about as long as the body; the basal flagellar segments of antennae about equal; mesoscutum closely punctate, coarsely and deeply so in the shallow depression just before the posterior margin; disk of scutellum apparently a little longer than broad at base, with a pronounced pitted groove just inside the lateral margins, leaving the margins as sharp ridges, and setting off a smaller triangular elevated area within; mesopleurae closely punctate and dull anteriorly and below the longitudinal crenulate furrow, highly polished above it; propodeum coarsely rugoso-reticulate with a prominent median longitudinal carina; radius directed strongly outward, and very slightly longer than the first intercubitus; outer spur of posterior tibiae distinctly a little longer than the inner, and much less than half as long as the metatarsus; abdomen a little shorter than the thorax, narrow at base, very broad on the third segment; first dorsal abdominal plate slender, broadest at base, narrowing a little posteriorly, twice as long as broad at base, rugulose; remainder of dorsum of abdomen smooth and polished; membranous margins along the first plate very narrow, except on the apical third; hypopygium not attaining apex of abdomen; ovipositor sheaths subexserted, straight. Black; clypeus, mandibles, and antennae black; labrum blackish; palpi pale, except at base; tegulae black; wings weakly infumated, the veins and stigma dark brown, the latter indistinctly paler at base; all coxae, basal segment of trochanters, base of fore and middle femora, and base and lower edges of posterior femora, black; all tarsi dusky. abdomen entirely black above and below.

Cocoon.—3.5 mm. long; cylindrical; not ribbed; pale grayish-brown in color.

Type locality.—Missoula, Montana.

Type.—Cat. No. 24009. U.S.N.M.

Host.—Geometrid larva on alfalfa.

Described from one specimen reared from an almost mature geometrid larva feeding on alfalfa, by W. H. Larrimer. The parasitic larva emerged from its host and spun cocoon April 16, 1916; eight days later the adult issued.

28. MICROPLITIS LATICINCTUS, new species.

Nearest to *varicolor* Viereck, from which it differs in its larger size; in the first dorsal abdominal plate not narrowing so strongly to the apex; in the second plate not being triangular; in the hypopygium of the female distinctly extending beyond the apex of the last dorsal abdominal segment; and in the slightly shorter metacarpus.

Female.—Length 3.5 mm. Head large, rather broad behind the eyes; the entire face, the vertex, temples and cheeks closely confluently punctate and dull; antennae very long, decidedly longer than the body; mesoscutum very closely confluently punctate and opaque, without parapsidal grooves; scutellum a little longer than broad at base, without distinct closely-placed punctures, dull; mesopleurae punctate and dull anteriorly and below the longitudinal crenulate furrow, very smooth and polished above it; propodeum coarsely rugoso-reticulate, with a median longitudinal carina; radius strongly tending outward, very slightly longer than first intercubitus; metacarpus very nearly as long as stigma; posterior coxae very short; inner spur of posterior tibiae a little longer than the outer and nearly half as long as the metatarsus; abdomen almost as long as the thorax; first dorsal abdominal plate slender, nearly parallel-sided, more than twice as long as broad at base, and a little narrower at apex than at base, finely rugulose, except for a polished line down the middle; membranous margins along the first plate very broad; second dorsal abdominal plate broad, extending entirely across abdomen, without membranous margins, and together with the following dorsal segments, smooth and polished; hypopygium large, extending prominently beyond apex of the last dorsal segment of abdomen; ovipositor slightly exserted. Black; head and thorax black; labrum, palpi, antennae mostly, tegulae and wing-bases, and the legs, except a small blackish spot on the outer face of posterior coxae at base, testaceous to reddish-testaceous; wings very slightly infumated, the veins and stigma brown, the latter with a distinct pale transparent spot in the membrane at base; abdomen with the first dorsal plate black; the membranous margins along this plate, and a broad band covering the second and third tergites, and part of the fourth, reddish-testaceous; apical tergites black; venter of the abdomen testaceous on the basal two-thirds, blackish beyond.

Male.—Essentially as in the female, except that the first dorsal abdominal plate is usually a little less roughened and more shining.

Cocoons.—5 mm. long; slender, attenuated at both ends; provided with several prominent longitudinal ridges; grayish-brown in color.

Type locality.—Oswego, New York.

Type.—Cat. No. 24001, U.S.N.M.

Described from one female labeled "Oswego, N. Y., July 17, 1896"; two males reared at the Gipsy Moth Laboratory, Melrose Highlands, Massachusetts, from cocoons, but without locality data, and one male labeled "Champaign, Ill. 16331." I have seen some additional material of this species: In the National Museum there is one other specimen from the C. F. Baker Collection, which was taken in Alabama under No. 1967. The Cornell University Collection contains specimens from Slaterville, Caroline, McLean, and Rock City, New York; and St. Hilaire, Quebec, Canada. In the collection of the Boston Society of Natural History there is a single specimen taken by Mr. C. W. Johnson at Chester, Massachusetts; and in material from the collection of the American Museum of Natural History I have seen specimens from Hornerstown, Forest Lawn, and Nyack, New York.

29. MICROPLITIS CONFUSUS, new species.

Closely resembles *kewleyi* in size and general appearance, and in the cocoons. It differs from that species in the first abdominal plate being distinctly no broader at apex than at base, and more rugulose, also in having usually a conspicuous testaceous band across the abdomen covering the 2nd and 3rd tergites.

Female.—Length, 2.3 mm. Face, vertex, temples, cheeks entirely confluently punctate and dull; antennae a little shorter than the body; mesoscutum, like the head, confluently punctate, except for a narrow, transverse, slightly elevated line along the posterior margin; parapsidal grooves wanting; scutellum small, flat, very weakly punctate, shining; mesopleurae mostly highly polished, with a longitudinal crenulate furrow below; propodeum coarsely rugose, with a median longitudinal carina; fore wings rather narrow; stigma large, much longer than the metacarpus; radius short, hardly as long as the first transverse cubitus, sometimes distinctly shorter; hind coxae finely granular at base; hind tibial spurs much less than half as long as the metatarsus; abdomen a little shorter than thorax, narrow at base, broad and much depressed posteriorly; the first dorsal plate nearly parallel-sided, the sides bulging slightly a little beyond the middle, base and apex apparently of equal breadth, mostly finely rugulose or ruguloso-striate; second tergite not distinctly separated from the third, and like the following segments, smooth and polished; hypopygium not surpassing the apex of the last dorsal segment; ovipositor hardly exserted. Black; head and thorax black; labrum and palpi testaceous; basal three-fourths of antennae testaceous to brownish, apical fourth usually fuscous; tegulae and the wing bases, and the four anterior legs, pale; posterior coxae blackish; the hind femora, hind tibiae except base, and the hind tarsi, usually more or less infuscated; wings hyaline, veins and stigma light brown, the latter with a large transparent spot at base; abdomen black, with the second tergite and most of the third usually reddish-testaceous, the broad membranous margins along the apical third of the first plate dingy yellowish; venter of abdomen yellowish on basal half, blackish beyond.

Male.—Like the female except for the longer antennae and the darker second and third abdominal tergites.

Cocoons.—2.5 mm. long; light brown, not fluted, and with a very small amount of loose silk; gregarious.

Type locality.—Port Huron, Michigan.

Type.—Cat. No. 23999, U.S.N.M.

Host.—Cutworms.

Described from nineteen specimens reared from a cutworm, at Port Huron, Michigan, July 3, 1916, by J. J. Davis, in the Bureau of Entomology, under Cage No. D 498.

In addition to the type series the National Collection contains the following material of this species: Five specimens, with cocoons, reared from a cutworm, at Lafayette, Indiana, in the Bureau of Entomology, under Cage No. C 1371-a; five specimens from Hagerstown, Maryland, W. E. Pennington, Collector, bearing Accession No. 2463; one specimen labeled "Texas, Belfrage"; and three specimens from the Collection of C. F. Baker bearing the following numbers: Cana. 2051, Cana. 2027, and Cana. 2540. I have also seen, in the Cornell University Collection, specimens from McLean and Rock City, New York; and Waubamic, Ontario, Canada.

30. MICROPLITIS BRADLEYI, new species.

Very similar to *brassicae*, from which it is readily separated, however, by the somewhat roughened first dorsal abdominal plate, by the rugulose and opaque face, and by the yellow fore and middle coxae.

Female.—Length 2.5 mm. Face rather coarsely ruguloso-punctate and opaque, the clypeus comewhat less so; antennae slender, about as long as the body; vertex, temples, and cheeks punctate and dull, though a little less so than the face; mesoscutum confluently punctate and pilose; parapsidal furrows wanting; scutellum a little longer than broad at base, shallowly punctate, opaque, pubescent; mesopleurae confluently punctate and opaque anteriorly and below the longitudinal crenulate furrow, highly polished above it; propodeum coarsely rugoso-reticulate, with a median longitudinal carina; stigma large, a little longer than metacarpus; radius directed outward and about as long as the first intercubitus; legs slender; posterior coxae short, rather smooth and shining; spurs of posterior tibiae less than half as long as the metatarsus; abdomen ovate, narrow at base, broadening posteriorly; first dorsal abdominal plate very slender, distinctly narrower at apex than at base, and more than twice as long as broad at base, smooth and polished on basal half, finely rugulose on the apical half; second dorsal plate small, triangular, broadest posteriorly, and like the following tergites, smooth and polished; membranous margins along sides of the two basal abdominal plates very broad; hypopygium not surpassing apex of the last dorsal segment; ovipositor subexserted. Black; labrum and palpi pale; tegulae and wing-bases testaceous; wings hyaline, the costa yellow, the remaining veins pale brownish to hyaline, the stigma light brown, with a large transparent spot in the membrane at base, legs yellowish, except the posterior coxae, which are black, and the apex of the posterior femora and tibiae and the posterior tarsi, which are dusky; abdomen black except the membranous margins along the two basal plates, which are yellowish-brown.

Type locality.—Sugar Pine, Madera County, California.

Type.—Cat. No. 564, Cornell University Collection.

Described from twenty-six female specimens collected by Dr. J. C. Bradley, at Sugar Pine, Madera County, California, 4,300–5,000 feet, August 24–31, 1914.

31. MICROPLITIS MONTANUS, new species.

Allied to *varicolor*, from which it differs in the blackish abdomen, in the blackish or dark reddish hind coxae, in the first dorsal abdominal plate narrowing less strongly to apex, and in the rather well indicated parapsidal grooves.

Female.—Length 2.8 mm. Head transverse, though rather full behind the eyes; face, except clypeus, which is indistinctly punctate and shining, vertex, and temples, minutely closely punctate and opaque; antennae hardly as long as the body; mesoscutum and scutellum shallowly confluently punctate and opaque, strongly pubescent; parapsidal grooves rather well indicated; mesopleurae closely punctate and dull anteriorly and below the deep crenate longitudinal furrow, highly polished above it; propodeum coarsely rugoso-reticulate, with a prominent median longitudinal carina, more shining than the mesonotum; radius tending outward, and very little, or not at all, longer than the first intercubitus; posterior coxae short, granular at base above; spurs of posterior tibiae apparently equal in length and much less than half the length of the metatarsus; abdomen a little shorter than the thorax, very slender at base, broader posteriorly; first dorsal abdominal plate very slender, more than twice as long as its greatest breadth, distinctly a little narrower at apex than at base, the sides bulging slightly somewhat before the apex, finely rugulose, the extreme apex elevated and highly polished; second plate broad, not triangular, not distinctly separated from the third, and like the following tergites, smooth and polished; hypopygium not attaining apex of the abdomen; ovipositor not exserted. Black; head and thorax black; labrum, palpi, tegulae and wing-bases, and the four anterior legs, yellow; posterior coxae largely dark reddish to blackish; posterior femora fuscous on apical third; posterior tibiae at apex, and the posterior tarsi, infuscated; wings hyaline, the veins and stigma yellowish-brown, the latter with a pale spot at base; abdomen black, more or less tinged with dark reddish at base; membranous margins along the first dorsal abdominal plate dingy yellowish-brown; venter of abdomen entirely blackish.

Male.—Essentially as in the female.

Cocoons.—3.5 mm. in length; somewhat irregularly ribbed; grayish-brown in color and covered with a little pale grayish silk; gregarious.

Type locality.—Santa Cruz Mountains, California.

Type.—Cat. No. 24010, U.S.N.M.

Host.—*Catocala verilliana* Grote.

Described from eight female and one male specimens, reared from *Catocala verilliana* Grote, in the Bureau of Entomology, under No. 538–o.

32. MICROPLITIS MATURUS Weed.

Microplitis maturus Weed, Trans. Amer. Ent. Soc., vol. 15, 1888, p. 294.
Microplitis cincta Ashmead, Canad. Ent., vol. 23, 1891, p. 3.
Microgaster tuckeri Viereck, Trans. Kansas Acad. Sci., vol. 19, 1905, p. 274.

Type.—In the Philadelphia Academy of Sciences; type of *cincta* in the United States National Museum; type of *tuckeri* in the University of Kansas.

New York; Connecticut; Michigan; Kansas; Vermont; Maryland; Illinois; Florida; Georgia; New Jersey; South Dakota; Canada.

Host.—*Drasteria*, species; "geometrid larva."

Cocoon.—4 mm. in length; cylindrical; not ribbed; pale brown in color; solitary.

There can be no question, I believe, that *cincta* Ashmead and *tuckeri* Viereck belong here. Notes made by Mr. Gahan on an examination of the type of *tuckeri* show beyond dispute that this species is *maturus*.

In addition to the types of *maturus* and *cincta* I have seen the following material: The National Collection contains many specimens from the following localities: Long Island; Ottawa, Canada; Stowe, Vermont; Hagerstown, Maryland; Elk Point, South Dakota (reared from a geometrid larva by C. N. Ainslie); Algonquin, Illinois; Agricultural College, Michigan; Jacksonville, Florida; Tifton, Georgia; Brookings, South Dakota; Anglesea, New Jersey; and Riley County, Kansas; several specimens, from Hagerstown, Maryland, are recorded as reared from *Drasteria*, species. In the Cornell University Collection there are specimens from Waterville and Ithaca, New York, and Coniston, Ontario, Canada.

HOSTS OF THE MICROGASTERINAE INCLUDED IN THIS PAPER.

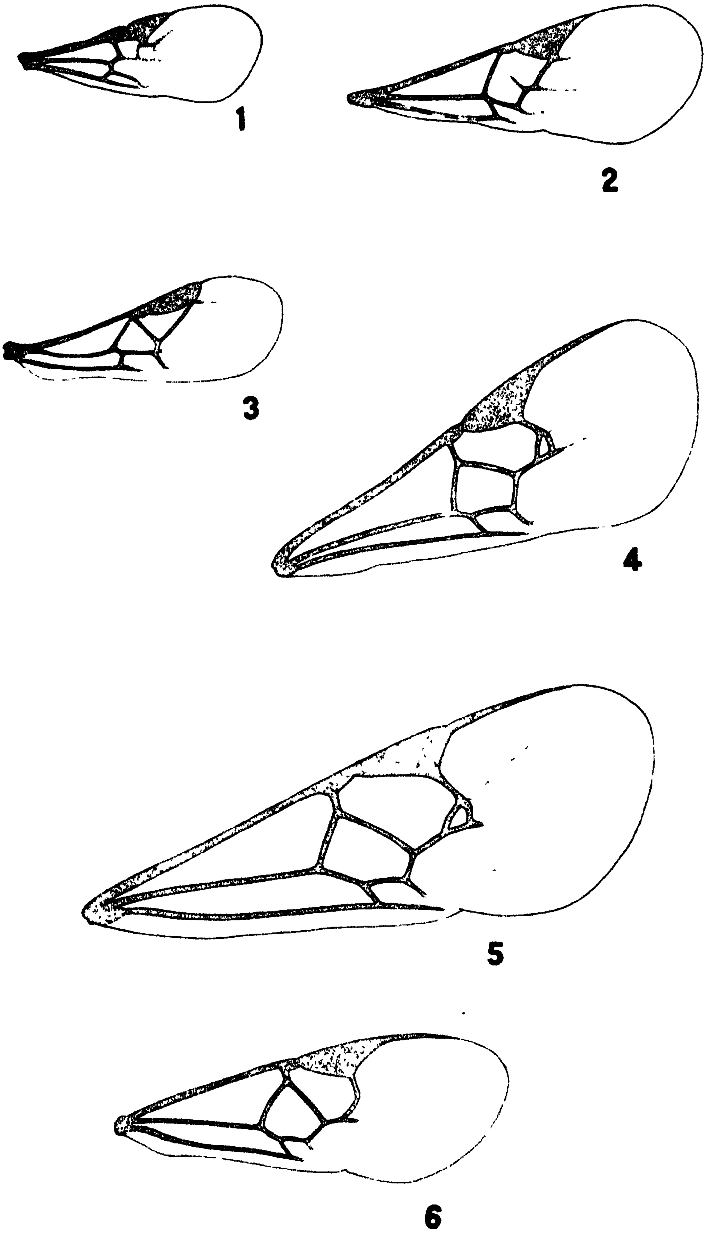
Achatodes zeae Harris	*Microplitis gortynae* Riley.
Acromycta hasta Guenée	*Microplitis hyphantriae* Ashmead.
Alypia octomaculata Fabricius	*Apanteles alypiae* Muesebeck.
Ancylis comptana Froelich	*Microgaster comptanae* Viereck.
Apatela furcifera Guenée	*Microplitis hyphantriae* Ashmead.
Arsilonche albovenosa Goeze	*Microplitis quadridentatus* Provancher.
Aspidisca splendoriferella Clemens	*Mirax aspidiscae* Ashmead.
Autographa brassicae Riley	*Microplitis brassicae* Muesebeck.

Autographa californica Speyer	*Microplitis alaskensis* Ashmead.
Canarsia hammondi Riley	*Microgaster ecdytolophae* Muesebeck.
Catocala verrilliana Grote	*Microplitis montanus* Muesebeck.
Ceratomia amyntor Geyer	*Microplitis ceratomiae* Riley.
Chloridea virescens Fabricius	*Microplitis croceipes* Cresson.
Cirphis unipuncta Haworth	*Microplitis melianae* Viereck; *varicolor* Viereck.
Diatraea, species	*Microplitis harnedi* Muesebeck.
Drasteria, species	*Microplitis maturus* Weed.
Ecdytolopha insiticiana Zeller	*Microgaster ecdytolophae* Muesebeck.
Ectoedemia castaneae Busck	*Mirax ectoedemiae* Rohwer.
Ectoedemia phleocophaga Busck	*Acoelius fasciipennis* Rohwer.
Epagoge sulfureana Clemens	*Microgaster epagoges* Gahan.
Euxoa, species	*Microplitis kewleyi* Muesebeck.
Feltia annexa Treitschke	*Microplitis feltiae* Muesebeck.
Feltia gladiaria Morrison	*Microplitis feltiae* Muesebeck.
Gelechia cercerisella Chambers	*Microgaster pantographae* Muesebeck.
(?) *Gelechia*, species	*Microgaster ecdytolophae* Muesebeck.
Gnorimoschema gallaesolidaginis Riley	*Microgaster gelechiae* Riley.
Grapholitha prunivora Walsh	*Mirax aspidiscae* Ashmead.
Hadena procincta Grote	*Microplitis alaskensis* Ashmead.
Heliothis obsoleta Fabricius	*Microplitis croceipes* Cresson.
Hydroecia immanis Grote	*Microplitis gortynae* Riley.
Hyphantria cunea Drury	*Microplitis hyphantriae* Ashmead.
Lithocolletes aceriella Clemens	*Mirax lithocolletidis* Ashmead.
Mamestra picta Harris	*Microplitis mamestrae* Weed.
Melitara junctolinella Hulst	*Apanteles mimoristae* Muesebeck.
Mimorista flavidissimalis Grote	*Apanteles mimoristae* Muesebeck.
Neleucania albilinea Hübner	*Microgaster auripes* Provancher; *Microplitis melianae* Viereck.
Noctua, species	*Microplitis coactus* Lundbeck.
Olene vagans Barnes and McDunnough	*Apanteles olenidis* Muesebeck.
Pantographa limata Grote & Robinson	*Microgaster pantographae* Muesebeck.
Paonias excaecatus Smith and Abbot	*Microplitis ceratomiae* Riley.
Papaipema nebris Guenée	*Microplitis gortynae* Riley.
Perigea sutor Guenée	*Microgaster calliptera* Say.
Phlyctaenia ferrugalis Hübner	*Microgaster phthorimaeae* Muesebeck.
Phthorimaea operculella Zeller	*Microgaster phthorimaeae* Muesebeck.
Physostesia, species	*Microgaster congregatiformis* Viereck.
Plathypena scabra Fabricius	*Microgaster facetosa* Weed; *Microplitis varicolor* Viereck.
Platysenta videns Guenée	*Microgaster calliptera* Say.
Plusia, species	*Microplitis alaskensis* Ashmead.
Plutella maculipennis Curtis	*Microplitis plutellae* Muesebeck.
Recurvaria piceaella Kearfott	*Microgaster zonaria* Say.
Recurvaria thujaella Kearfott	*Microgaster zonaria* Say.
Schizura concinna Smith and Abbot	*Microgaster schizurae* Muesebeck.
Schizura unicornis Smith and Abbot	*Microgaster schizurae* Muesebeck.
Sphinx drupiferarum Smith and Abbot	*Microplitis ceratomiae* Riley.
Sphinx gordius Cramer	*Microplitis ceratomiae* Riley.
Swammerdamia castaneae Busck	*Microgaster swammerdamiae* Muesebeck.
Vanessa atalanta Linnaeus	*Microgaster carinata* Packard.
Xylina, species	*Microplitis hyphantriae* Ashmead.

EXPLANATION OF PLATE.

FIG. 1. Fore wing of *Elasmosoma vigilans* Cockerell.
2. Fore wing of *Mirax ectoedemiae* (Rohwer).
3. Fore wing of *Adelius fasciipennis* (Rohwer).
4. Fore wing of *Microplitis ceratomiae* Riley.
5. Fore wing of *Microgaster gelechiae* Riley.
6. Fore wing of *Apanteles congregatus* Say.

NOTE.—These figures are intended to show only venation. No attempt has been made to indicate infuscated areas, or the arrangement of setae.



NORTH AMERICAN ICHNEUMON-FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 74

INDEX.

This index includes all species treated in this paper. Valid generic names are in boldface type; valid specific names in roman; synonyms in italics; supergeneric names in capitals and small capitals.

Page.
Acaelius Haliday 12
Acoelius Haliday, Foerster 12
Adelius Haliday 12
alaskensis Ashmead, Microplitis 53
aletiae Riley, apanteles 15
Allapanteles Brethés 15
alypiae Muesebeck, Apanteles 18
annulicornis (Ashmead) apanteles 15
Anomopterus Rohwer 12
Apanteles Foerster 15
aspidiscae Ashmead, Mirax 11
auripes Provancher, Microgaster 31
autographae Muesebeck, Microplitis 54
bakeri Ashmead, Elasmosoma 6
bakeri Muesebeck, Microgaster 29
banksi Viereck, Apanteles 15
berolinense Ruthe, Elasomosoma 5
bisstigmata Say, Microgaster 43
bradleyi Muesebeck, Microplitis 70
brassicae Muesebeck, Microplitis 59
brevicauda Provancher, Microgaster 31
brittoni Viereck, Microgaster 36
calliptera Say, Microgaster 27
canadensis Muesebeck, Microgaster 38
carinata Packard, Microgaster 38
carinatus Ashmead, Microplitis 50
caudatus Muesebeck, Apanteles 16
cecidiptae (Brethés), Apanteles 15
Centistidea Rohwer 10
ceratomiae Riley, Microplitis 55
cincta Ashmead, Microplitis 72
coactus Lundbeck, Microplitis 61
Coelothorax Ashmead 9
coloradensis Muesebeck, Adelius 14
coloradensis Muesebeck, Microplitis 49
comptanae Viereck, Microgaster 38
concolor Szepligeti, Oligoneurus 9
confusus Muesebeck, Microplitis 69
congregatiformis Viereck, Microgaster 42
Cotesia Cameron 15

Page.
crenulatus (Provancher), Microplitis 52
croceipes (Cresson), Microplitis 56
Cryptapanteles Viereck 15
deprimator (Fabricius), Apanteles 20
Diolcogaster Ashmead 20
Dirrhope Foerster 15
Dolichogenidea Viereck 15
ecdytolophae Muesebeck, Microgaster 24
ectoedemiae (Rohwer), Mirax 12
Elasmosoma Ruthe 5
emarginatus Riley, Apanteles 15
epagoges Gahan, Microgaster 41
ephyrae (Ashmead), Apanteles 15
facetosa Weed, Microgaster 32
fasciipennis (Rohwer), Adelius 14
feltiae Muesebeck, Microplitis 62
femoralis Muesebeck, Microgaster 39
flavipes (Cameron), Apanteles 15
garmani (Ashmead), Microgaster 26
gelechiae Riley, Microgaster 30
Glyptapanteles Ashmead 15
gortynae Riley, Microplitis 58
grapholithae Ashmead, Mirax 11
grenadensis Ashmead, Apanteles 16
halidaii Marshall 4
harnedi Viereck, Apanteles 16
harnedi Muesebeck, Microgaster 33
Hygroplitis Thomson 20
hyphantriae Ashmead, Microplitis 55
Hypomicrogaster Ashmead 20
iridescens Cresson, Microgaster 28
kewleyi Muesebeck, Microplitis 51
laeviceps (Ashmead), Mesocoelus 9
lateralis Provancher, Microgaster 42
laticinctus Muesebeck, Microplitis 67
latistigmus Muesebeck, Microplitis 63
lithocolletidis Ashmead, Mirax 10
longicaudus Muesebeck, Microplitis 57
maculipennis Cresson, Microgaster 27

Page.
mamestrae Weed, Microplitis 52
manilae (Ashmead), Apanteles 15
marginiventris (Cresson) Apanteles 16
maturus Weed, Microplitis 72
mediata Cresson, Microgaster 27
mellianae Viereck, Microplitis 59
melligaster Provancher, Microgaster 33
Mesocoelus Schulz 9
mexicana Cameron, Microgaster 42
Microgaster Latreille 20
Microgasteridae 7
Microgasterides 7
MICROGASTERINAE 6
Microgasteroidae 6
Microplitis Foerster 43
mimoristae Muesebeck, Apanteles 19
minuta Ashmead, Mirax 12
Mirax Haliday 10
montanus Muesebeck, Microplitis 71
NEONEURINAE 8
Neoneurus Haliday 11
nigripectus Muesebeck, Adelius 13
nigripennis Ashmead, Microplitis 56
nigritus Muesebeck, Microplitis 58
obscura (Nees), Apanteles 15
olenidis, Muesebeck, Apanteles 18
Oligoneurus Szepligeti 9
paleacritae Riley, Apanteles 15
pallida Ashmead, Mirax 10
pantographae Muesebeck, Microgaster 34
Paramirax Ashmead 5
Parapanteles Ashmead 15
pergandei Ashmead, Elasmosoma 6
perplexus Muesebeck, Microplitis 49
phthorimaeae Muesebeck, Microgaster 40
Pleiomerus (Wesmael) Ratzeburg 12
plutellae Muesebeck, Microplitis 60
Protapanteles Ashmead 15

Page.
Protomicroplitis Ashmead 20
Pseudapanteles Ashmead 15
quadridentatus (Provancher), Microplitis 53
quintilis Viereck, Microplitis 62
recurvariae (Ashmead), Microgaster 24
rubricoxa Provancher, Microgaster 33
rufa Foerster, Dirrhope 15
rufilabris Haliday, Mirax 10
rugosus Muesebeck, Microplitis 48
russata Haliday, Microgaster 20
schizurae Muesebeck, Microgaster 30
schwarzi Ashmead, Elasmosoma 5
schwarzi Ashmead, Paramirax 5
scitulus Riley, Apanteles 15
scutellatus Muesebeck, Microplitis 66
sesamiae Cameron, Apanteles 15
solidaginis Viereck, Microgaster 32
sordipes (Nees), Microplitis 43
Stenopleura Viereck 15
stigmaticus Muesebeck, Microplitis 47
striatus Muesebeck, Microplitis 64
subfaciatus Haliday, Adelius 12
swammerdamiae Muesebeck, Microgaster 37
terminatus Weed, Microplitis 53
texana Muesebeck, Mirax 11
tuckeri (Viereck), Microplitis 43, 72
unicolor (Curtis), Apanteles 42
Urogaster Ashmead 15
varicolor Viereck, Microplitis 65
vigilans Cockerell, Elasmosoma 6
vulgaris (Ashmead), Apanteles 15
waldeni Viereck, Microplitis 55
xanthaspis (Ashmead), Microgaster 28
zonaria Say, Microgaster 23

NEW PEARLY FRESH WATER MUSSELS FROM SOUTH AMERICA.

By William B. Marshall,
Assistant Curator, Division of Mollusks, United States National Museum.

This paper is based upon three sendings to the United States National Museum of naiads from South America. They are:

A collection made by Dr. C. Wythe Cooke, of the United States Geological Survey, in the Province of Santander, United States of Colombia. This has yielded a new species, *Diplodontites cookei*, which necessitates the erecting of a new genus for its reception, and another new species, *Anodontites colombiensis*.

Another lot comes from Dr. Henry Pittier, of the Bureau of Plant Industry of the United States Department of Agriculture, which, among other things, contains a new species, *Anodontites pittieri*, from Venezuela.

In addition to these there are also here described five new species, *Diplodon subcylindricus*, *D. subquadratus*, *D. arcuatus*, *D. trivialoides*, and *Monocondylaea felipponei*, from Uruguay. These are part of a splendid series of specimens recently donated to the United States National Museum by Dr. Florentino Felippone, of Montevideo.

DIPLODONTITES, new genus.

Naiads without lateral teeth and with pseudocardinal teeth of the character of those *Diplodontites cookei* herein described and as yet the only known species of the genus. The sinulus is like that of the genus *Anodontites.*

The most important features of this genus lie in the hinge characters. The triangular sinulus and the absence of lateral teeth distinguish it from the genus *Diplodon*, while the presence of pseudocardinal teeth distinguish it from the genus *Anodontites*. On the other hand, the possession of the pseudocardinals may indicate some relationship to *Diplodon* while the nature of the sinulus may indicate some relationship to *Anodontites*. Thus, by shell characters. it stands between the two genera mentioned. In North American naiads a somewhat similar condition is found. Some of these have pseudocardinals and laterals, some have pseudocardinals only, and others have neither.

Genotype.—*Diplodontites cookei*, new species.

DIPLODONTITES COOKEI, new species.

Plate 1, figs. 1, 3, 7, 8, 10; plate 3, fig. 4.

Shell moderately thick, elliptical in outline, rounded anteriorly and posteriorly. Slightly gaping in front, posterior dorsal margin lightly arched, the dorsal ridge rather full and rounded, beaks moderately elevated (so eroded that any sculpture that may have existed is lost). Periostracum clothlike, dull, closely adhering, showing no tendency to peel. Color yellowish olive, the posterior dorsal area of each valve with 10 radiating greenish stripes. Radiating sculpture consisting of a number of clearly defined impressed lines which are nearly equally spaced and between which are many microscopic radiating slightly waving, striae—about 40 of these striae between each pair of impressed lines. With sufficient magnification each of these striae is seen to consist of innumerable granules. Concentric sculpture consisting of many irregular, slightly raised minor lines of growth, which are interrupted by each of the radiating impressed lines, between each pair of which the concentric lines bend downward in directions radiating from the beaks, crinkling and drooping like festooned drapery. To the naked eye this festooning is hardly visible, but under a lens it becomes one of the most striking features. Three principal stages of growth are indicated. Color of interior varying from whitish to pinkish, moderately iridescent, anterior adductor scar impressed, deep at its upper end, posterior scar but lightly impressed. Sinulus triangular like that of *Anodontites*. No lateral teeth in either valve. Right valve with three pseudocardinal teeth, the front one being strongest, high and triangular, the second low and longer, the posterior one indistinctly differentiated from the hinge plate. The socket between the first and second is large, deep, triangular, the socket between the second and third is a lengthened narrow groove, its bottom and walls with many sharp defined lines of growth. Left valve also with three pseudocardinal teeth, the front one nearly obsolete, the middle one being very large and triangular, the posterior one long and low. The socket between the first and second is very deep, that between the second and third is similar to the corresponding socket in the right valve and has similar growth markings. Prismatic border narrow, greenish-olive, minutely granulous.

The type (Cat. No. 341473, U.S.N.M.), measures: Length 53 mm., height 32 mm., diameter 20 mm. It and two other specimens and an odd valve come from a tributary of the Rio Colorado (which in turn becomes tributary to the Rio Magdalena), in the Province of Santander, Colombia. They were presented by Dr. C. Wythe Cooke, of the Geological Survey, who collected them in April, 1920, and in whose honor the species is named.

The sculpture of the exterior is remarkable and of great beauty. The radiating striae between the impressed radiating lines are of a fineness rarely if ever equaled in shells with the rude structure of the naiads.

DIPLODON SUBCYLINDRICUS, new species.

Plate 2, figs. 1, 2; plate 3, figs. 1, 2, 11.

Shell long, nearly elliptical, anterior end regularly rounded, posterior end nearly regularly rounded but obscurely bluntly angled near the lower side, ventral and dorsal margins subparallel. Both the anterior and posterior ridges full and rounded, the descent to the dorsal margins very abrupt, giving the shell a gibbous form. Beaks not very high, with 15 rather coarse radiating ribs. Surface rather smooth, with many concentric lines of growth. Periostracum closely adhering, slightly glossy. Color nearly uniform chestnut. Nacre silvery white. Pseudocardinals of right valve two, platelike, very long, the inner one beginning near the beak and reaching almost to the adductor scar, the outer one nearly as long, slightly overtopping the inner one. Left valve with but one pseudocardinal which is very long, somewhat paddle-shaped, very thin and slightly bent upward. Right valve with one lateral tooth which is somewhat distant from the beak and has its posterior end roughened. Laterals of left valve quite distant from the beak, short, inconspicuous.

The type (Cat. No. 341375, U.S.N.M.) measures: Length 82 mm., height 35 mm., diameter 42 mm. It comes from Arroyo Manga, Department of Montevideo, Uruguay. Other specimens in the collection, all from Uruguay, are as follows: A right valve from the Department of Canelones (Cat. No. 335776); a specimen from Arroyo Sauco in the same Department (Cat. No. 331282); a right valve from Maldonado, Department of Maldonado (Cat. No. 335775). All the above-mentioned specimens were collected and presented by Dr. Florentino Felippone.

The nearest relative of this species is *Diplodon piceus* Lea, which however, is much smaller, proportionally thicker, has a black epidermis, and differs in the character of the teeth.

DIPLODON SUBQUADRATUS, new species.

Plate 2, figs. 6, 8; plate 3, figs. 8–10.

Shell subquadrate, moderately inflated, moderately thick, broadly truncated posteriorly, narrowly truncated anteriorly. Anterior and posterior dorsal areas compressed as if pinched, posterior ridge rounded, descending abruptly to the dorsal area. Escutcheon very narrow, anterior margins flexuous and with a broad lunule unevenly divided, the portion in the right valve being the larger. Dorsal margin arched, ventral margin rounded, angular at the front and back ends. Periostracum closely adhering, unctuous, rather glossy. Color nearly uniformly dark chestnut, very obscurely divided into a lighter anterior and darker posterior portion. Beaks very full and high, eroded, but retaining vestiges of sculpture consisting of stout, radiating ribs. Surface of shell crudely concentrically striated, very obscurely radiated with faint impressed lines, rest periods not very prominently marked. Nacre silvery white. Lower pseudocardinal tooth of right valve thin, high, long, and curved, the upper cardinal minute, groove between the two long, broad, and deep. Anterior pseudocardinal of left valve wedge-shaped, thick and large, the posterior one small and low, the groove between the two being small and shallow and narrow. Lateral teeth of both valves much bowed, the right lateral being very stout and high. Laterals of left valve subequal, the groove between them broad and deep.

The type (Cat. No. 335774, U.S.N.M.) measures: Length 68 mm., height 55 mm., diameter 33 mm. It comes from Paysandu, Uruguay, and was presented by Dr. F. Felippone.

This shell is related to both *Diplodon gratus* Lea and *patelloides* Lea. It differs from both in the squarish form, the truncated front and rear, the very full and high beaks which are nearly cordate, the broad lunule, the pinched and flexuous anterior portion and to a lesser extent in the character of the teeth. The shell has a cordate appearance, which in the young stage must be more marked than in the adult.

DIPLODON ARCUATUS, new species.

Plate 1, figs. 4, 6; plate 2, figs. 7, 10; plate 3, fig. 3.

Shell subrotund, moderately solid, much inflated, the greatest diameter being located posterior to the beaks, narrowed and shortly rounded anteriorly, very broad and very widely rounded posteriorly, the posterior dorsal area broad and sloping and wedge-shaped. Beaks in front of the highest point of the shell, facing forward, eroded but bearing indications of having had several coarse radiating ribs. Periostracum thick, nearly uniformly blackish brown throughout, with very faint indications of radiating striae. Surface of shell roughened by a number of rude, elevated concentric lines of growth. Interior pale pinkish flesh-color, lightly pearly (much pearly luster probably lost). Anterior adductor scars deeply impressed, posterior scars superficial. Hinge line greatly arched. Right valve with two pseudocardinal teeth located in front of the beak, the inner one lamelliform, very long and very high, the outer one very small, the pit between the two teeth at a considerable distance from the beak. Left valve with a long, thin, tonguelike pseudocardinal. Right valve with a very short, high, curved lateral tooth. Left valve with two lateral teeth, the groove between them long and shallow, the inner tooth thin and high, the outer tooth thin, low, and obscure. Upper edges of the teeth minutely crenulated. Prismatic border very narrow.

The type (Cat. No. 341376, U.S.N.M.) measures: Length 39 mm., height 34 mm., diameter 23 mm. It comes from Barra de Sacra, Department of Paysandu, Uruguay, and was collected and presented by Dr. Florentino Felippone.

Externally this shell in a general way resembles *Diplodon disculus* Lea, except that it is much more inflated and has no indication of a posterior wing. The external features which attract attention are its inflation, the flattened, sloping posterior dorsal area, the apparent tilting forward of the umbonal area and the uniform dark color of the periostracum. Internally the shell widely differs from any hitherto known *Diplodon*. In the character of the hinge line and teeth it does not fall into any of the groups into which the genus has been arranged and for the present it must be the sole occupant of a new group.

DIPLODON TRIVIALOIDES, new species.

Plate 1, figs. 12, 14; plate 2, figs. 3, 5; plate 3, fig. 12.

Shell subelliptical in outline, moderately inflated behind the middle, rather thin posteriorly, somewhat thickened anteriorly, rounded and narrower and slightly gaping in front, obliquely truncated and obscurely sinuated behind. Dorsal margin slightly arched; ventral margin oblique, nearly straight; body of shell broadly but slightly compressed from the beaks to the middle of the ventral margin; posterior ridge wide. inflated, evenly rounded; posterior dorsal slope with two obscure, broad and shallow radial grooves. Color brownish olive and greenish, with very obscure lighter rays; a fairly well-marked light ray from the beaks to a point just behind the middle of the ventral margin divides the coloring into two parts, the anterior portion being the lighter in color. Beaks full and high, well forward, concentrically striated, and with a number of heavy radiating ribs, those on the anterior and posterior areas being somewhat threadlike. Periostracum closely adherent, smooth, unctuous, with a dull gloss. Cavity of shell moderately deep. Posterior cardinal tooth of right valve high, its surface crenulated. Anterior right cardinal thin, long, inconspicuous. Cardinal of left valve narrow, its lower end buttressed to the upper edge of the adductor scar. Right lateral high, thin, winglike, crenulated. Left laterals close together, outer one small, inner one rising to prominence behind, both with the edge crenulated. Nacre white, pearly, but not very iridescent.

The type (Cat. No. 335770, U.S.N.M.) measures: Length 55 mm., height 33 mm., diameter 21 mm. It is one of a lot of four specimens from Arroyo Bellaco, Department of Paysandu, Uruguay. Cat. No. 340887 includes another specimen from the same locality. Cat. No. 340886 includes one specimen from the Uruguay River at Paysandu. Cat. No. 335771 includes one specimen from Arroyo la Boyado, Department of San Jose, and Cat. No. 335772 includes a single valve from Arroyo Canelon Chico, Department of Canelones, Uruguay. All the specimens were received from Dr. Florentino Felippone of Montevideo.

As the name indicates, this species is closely related to *Diplodon trivialis* Simpson, from which it differs chiefly in the character of the umbos. Fortunately the sculpture of the beaks of the types of both *trivialis* and *trivialoides* is sufficiently well preserved to show that they differ markedly, the sculpture of the former being fine radial threadlike raised lines, while the sculpture of the latter consists of coarse radial ribs. *Trivialoides* is also closely related to *peculiaris* Lea, from which it differs in form and in character of periostracum. The four specimens in the type lot are remarkably uniform in all details and any one might have served as the type.

In the natural condition of the shell the division into two areas of color is not very striking; but if the shell be cleaned with oxalic acid, this characteristic becomes one of the most noticeable features of the species.

ANODONTITES PITTIERI, new species.

Plate 1, figs. 9, 11; plate 2, figs. 9, 12; plate 3, fig. 6.

Shell high, roundly subquadrate, compressed, rather thin, slightly thicker at the middle than at the ends. Valves closed all round. Convexity nearly equally rounded, without a clearly defined posterior ridge, with several obsolete radiating ribs on the posterior dorsal area, these ribs with faint indications of green coloring. Anterior portion of surface vernicose. Posterior portion dull and much roughened by concentric lamellae of periostracum. Middle portion with several radiating, faintly impressed lines and several radiating rufflings of the periostracum. Principal rest periods six, indicated by dark concentric lines. Vicinity of the beaks flesh color, rest of shell dark straw color, deepening to light chestnut in front. Nacre pinkish and slightly pearly, in the cavity of the shell, brilliantly iridescent at the adductor scars and in a band just above the prismatic border. Interior everywhere finely radiately striated except on the prismatic borders. All adductor scars superficial, not appreciable to touch. Prismatic border very broad, occupying one-seventh of the height of the shell, and of a livid, slightly greenish hue, minutely granulous. Sinulus very large, distinctly hooked at its lower end.

The type (Cat. No. 339954, U.S.N.M.) measures: Length 50 mm., height 35 mm., diameter 17 mm. It comes from Guaremales, Venezuela, and was collected by Dr. Henry Pittier of the United States Department of Agriculture. This species is named in honor of Dr. Henry Pittier, whose explorations in tropical America have greatly enriched the National Museum's collections.

This species classifies next to *A. tortilis* Lea, of which *A. luteolus* Lea and *A. schomburgianus* Sowerby are supposed to be synonyms. *A. pittieri* has a more chunky form, a pinkish nacre instead of bluish, has a prismatic border about three times as wide and has a much larger sinulus which has a distinct hook at its lower end. The anterior adductor scars of *tortilis* are deeply impressed, while those of *pittieri* are entirely superficial.

ANODONTITES COLOMBIENSIS, new species.

Plate 1, fig. 5; plate 2, figs. 13, 14; plate 3, figs. 5, 13, 14.

Shell large, thick, elongate, moderately inflated, prominently constricted from the beaks to the ventral margins. The ventral margins deeply incurved, valves widely gaping from the point of construction of the ventral margin to the anterior end. Dorsal margin regularly and highly arched, posterior portion of the shell elongated and drawn obliquely downward. Both ends regularly rounded. Posterior dorsal ridge inflated, rounded, with no indication of an angular tendency. Periostracum thick, dull, cloth-like, closely adhering. Entire surface roughened by many fine irregular wrinkles and puckers radiating from the beaks. A similar wrinkling is obscurely seen in the nacre, especially in the portion between the mantle scar and the ventral border. Color uniform dark chestnut with several radiating green stripes on the posterior dorsal area. Interior dull, very slightly pearly, livid, with touches of green in the posterior portion and salmon-colored tints in the deeper portion of the valves, the remainder bluish. Anterior adductor scars deeply impressed, posterior scars well impressed but not deep. Sinulus rather large with a distinct hook at its lower end. Prismatic border narrow, widest at the posterior ventral end, of a dark olive green color.

The type (Cat. No. 341472, U.S.N.M.) measures: Length 82 mm., height 37 mm., diameter 26 mm. It and three other specimens come from a tributary of the Rio Colorado in the Province of Santander, United States of Colombia, and was collected and presented by Dr. C. Wythe Cooke. The Rio Colorado becomes tributary to the Rio Magdalena and is in the Caribbean drainage system. This is on the western slope of the Cordillera Oriental and is separated by high mountains from the great areas drained by the Orinoco and Amazon River systems.

Externally this shell closely resembles many of the arched specimens of the common *Margaritana margaritifera* of the Northern Hemisphere. Its relation to *Anodontites* of the *tenebricosus* group is quite evident and its nearest ally in that group is *A. clessini* Fischer. The constriction in this species is much more marked than in any of the other species of the group. The degree of constriction increases with the age of the shell. One specimen, apparently quite old, is much more constricted than the type.

The character of the periostracum is very peculiar on account of the great number of fine wrinkles. At first glance these wrinkles appear to be due to shrinkage, but the great number of them would call for an amount of shrinkage that would seem to be unreasonable. The occurrence of similar wrinkles, though in obscure form, in the nacre indicates that they arise from the structure of the animal and are not due to shrinkage. All four of the specimens at hand are wrinkled in the same way.

MONOCONDYLAEA FELIPPONEI, new species.

Plate 1, figs. 2, 13; plate 2, figs. 4, 11; plate 3, fig. 7.

Shell much inflated, subrotund in form, narrowed anteriorly, very wide and nearly squarely truncate posteriorly. Posterior dorsal ridge rounded, not angled, but the ridge thrown into prominence by a radiating line of dark color. Ventral edge broadly rounded, obscurely angled at its middle and at its posterior end. Anterior end slightly gaping. Posterior margin nearly at right angles with the dorsal margin. Periostracum thick, clothlike, without gloss, its surface much roughened by numerous concentric lamellae. Color dark olive green. Interior somewhat iridescent, with a more or less rosy tinge throughout, which is more marked in the middle portion. Parts of the interior with a greenish tinge. Anterior adductor scar deeply impressed, posterior scar superficial. Hinge line undulating, the single tooth in each valve knoblike. Prismatic border very broad ventrally, very narrow elsewhere.

The type (Cat. No. 340663, U.S.N.M.) measures: Length 33 mm., height 27 mm., diameter 19 mm. It comes from Barra del Arroyo Sacra, Department of Paysandu, Uruguay, and was collected and presented by Dr. Florentino Felippone.

This species is quite different from any *Monocondylaea* hitherto described. It seems to stand intermediate between *M. paraguayana* Lea and *M. franciscana* Moricand.

EXPLANATION OF PLATES.

PLATE 1.

All figures except 5 and 10 reduced one-third.

FIG. 1. *Diplodontites cookei*, new species. Right valve.
2. *Monocondylaea felipponei*, new species. Left valve.
3. *Diplodontites cookei*, new species. Left valve.
4. *Diplodon arcuatus*, new species. Right valve.
5. *Anodontites colombiensis*, new species. External sculpture × about 6.
6. *Diplodon arcuatus*, new species. Left valve.
7. *Diplodontites cookei*, new species. Left valve.
8. *Diplodontites cookei*, new species. Right valve.
9. *Anodontites pittieri*, new species. Right valve.
10. *Diplodontites cookei*, new species. External sculpture × about 24.
11. *Anodontites pittieri*, new species. Left valve.
12. *Diplodon trivialoides*, new species. Right valve.
13. *Monocondylaea felipponei*, new species. Right valve.
14. *Diplodon trivialoides*, new species. Left valve.

PLATE 2.

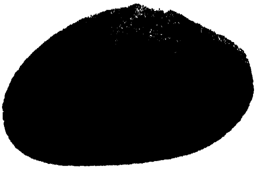
All figures reduced one-third.

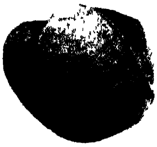
FIG. 1. *Diplodon subcylindricus*, new species. Left valve.
2. *Diplodon subcylindricus*, new species. Right valve.
3. *Diplodon trivialoides*, new species. Left valve.
4. *Monocondylaea felipponei*, new species. Left valve.
5. *Diplodon trivialoides*, new species. Right valve.
6. *Diplodon subquadratus*, new species. Left valve.
7. *Diplodon arcuatus*, new species. Left valve.
8. *Diplodon subquadratus*, new species. Right valve
9. *Anodontites pittieri*, new species. Left valve.
10. *Diplodon arcuatus*, new species. Right valve.
11. *Monocondylaea felipponei*, new species. Right valve.
12. *Anondontites pittieri*, new species. Right valve.
13. *Anondontites colombiensis*, new species. Left valve.
14. *Anodontites colombiensis*, new species. Right valve.

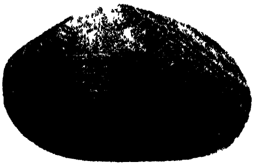
PLATE 3.

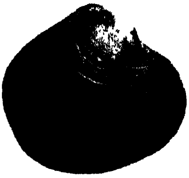
All figures reduced one-third.

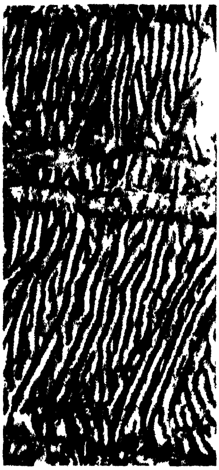
FIG. 1. *Diplodon subcylindricus*, new species. Right valve.
2. *Diplodon subcylindricus*, new species. Left valve.
3. *Diplodon arcuatus*, new species. Dorsal view.
4. *Diplodontites cookei*, new species. Dorsal view.
5. *Anondontites colombiensis*, new species. Dorsal view.
6. *Anondontites pittieri*, new species. Dorsal.
7. *Monocondylaea felipponei*, new species. Dorsal view.
8. *Diplodon subquadratus*, new species. Right valve.
9. *Diplodon subquadratus*, new species. Left valve.
10. *Diplodon subquadratus*, new species. Dorsal view.
11. *Diplodon subcylindricus*, new species. Dorsal view.
12. *Diplodon trivialoides*, new species. Dorsal view.
13. *Anodontites colombiensis*, new species. Right valve.
14. *Anodontites colombiensis*, new species. Left valve.

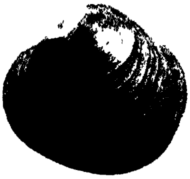

1

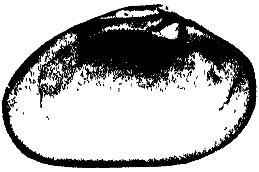

2

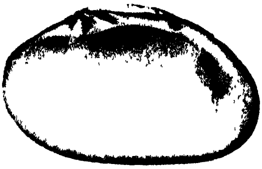

3

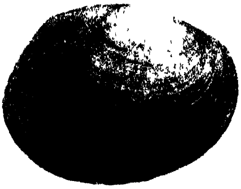

4


5

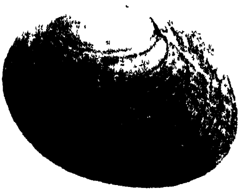

6

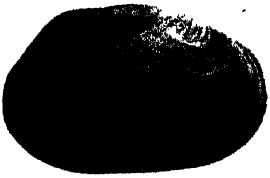

7

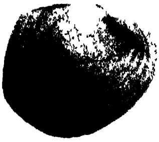

8

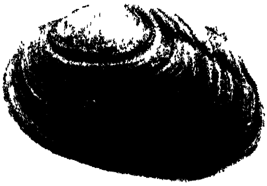

9

10


11

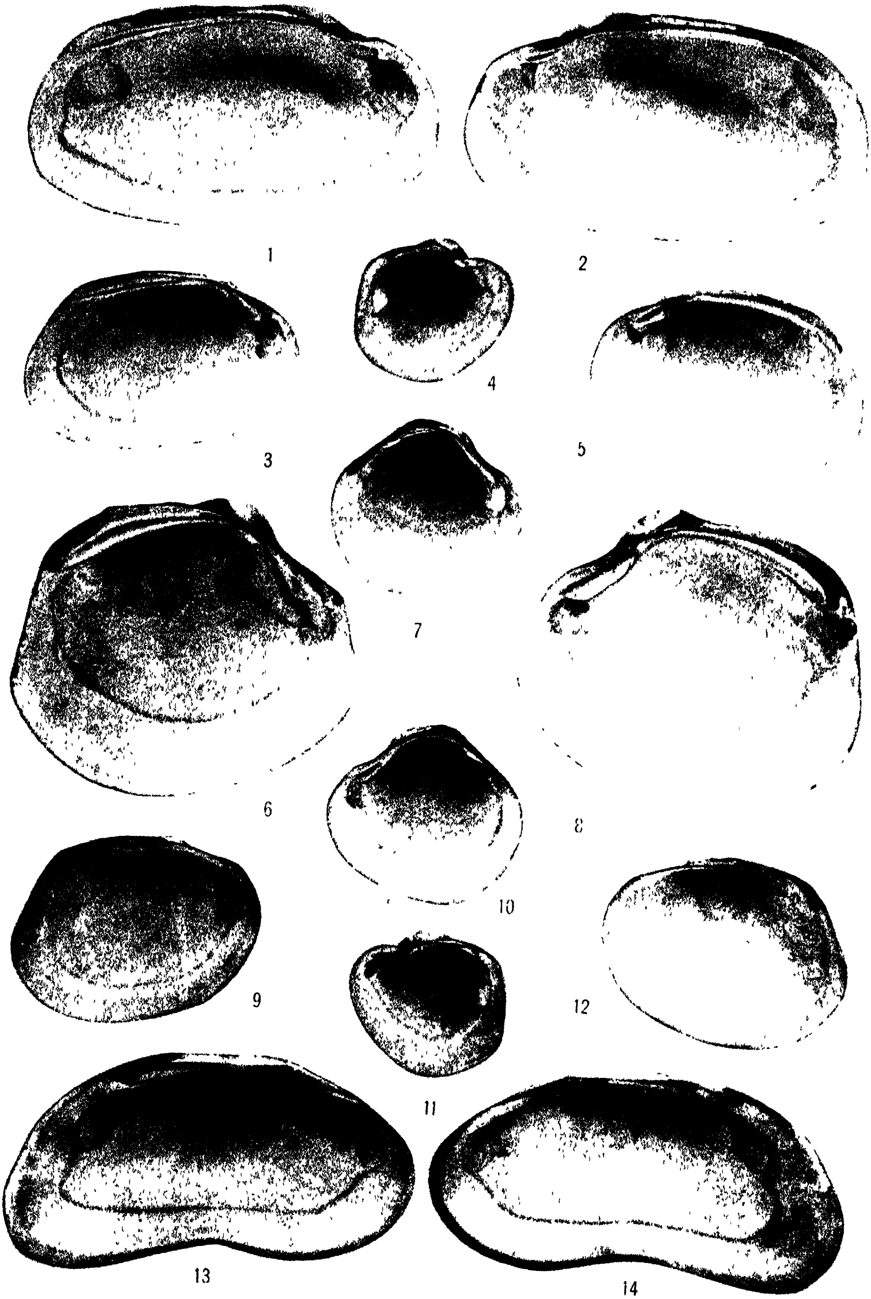

12


13


14

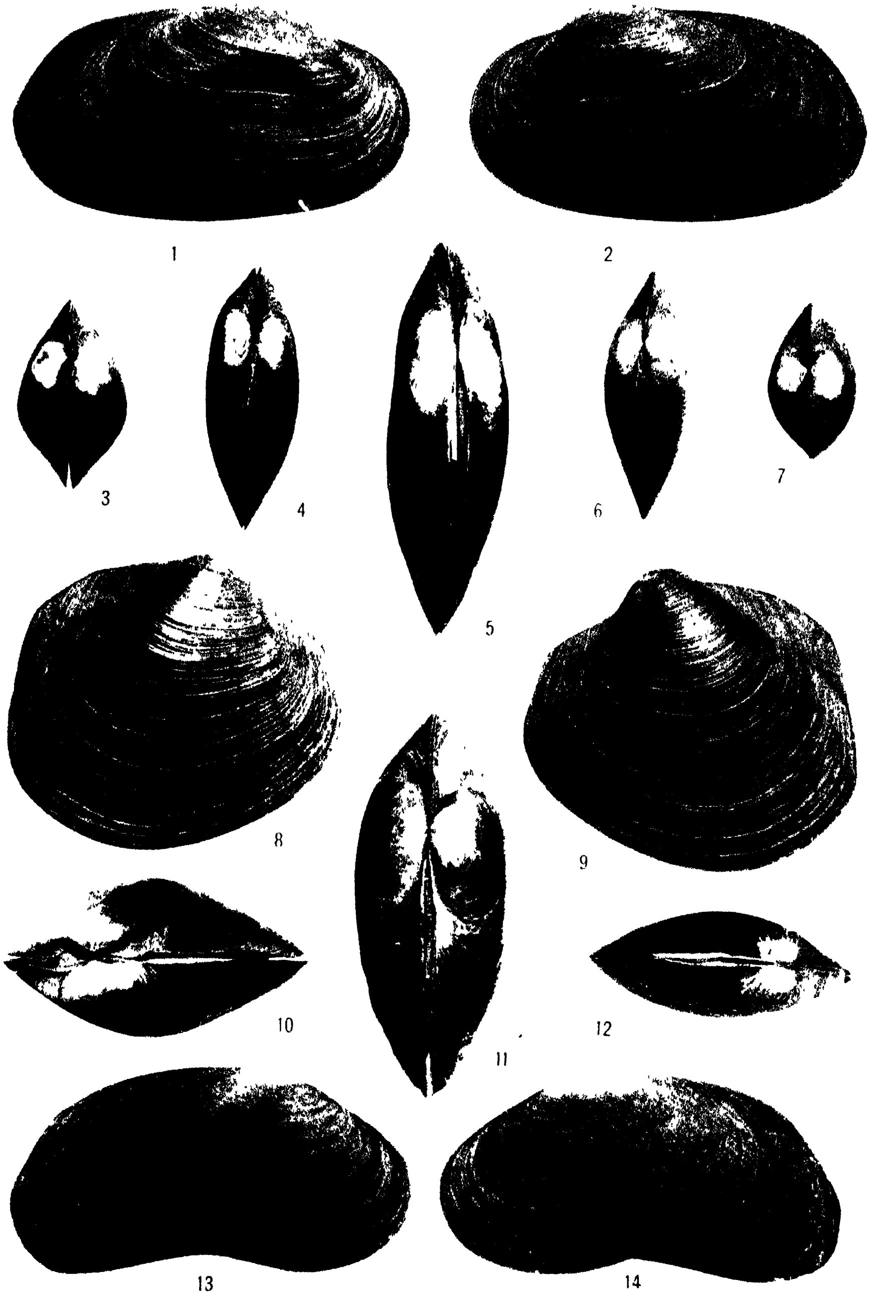
SOUTH AMERICAN FRESH WATER MUSSELS.

FOR EXPLANATION OF PLATE SEE PAGE 9.



SOUTH AMERICAN FRESH WATER MUSSELS.

FOR EXPLANATION OF PLATE SEE PAGE 9



South American Fresh Water Mussels.

For explanation of plate see page 9.

DESCRIPTION OF A NEW FOSSIL SEA COW FROM FLORIDA, METAXYTHERIUM FLORIDANUM.

By Oliver P. Hay.

Associate of the Carnegie Institution of Washington.

In the United States National Museum is a part of the upper right maxilla of a sirenian which is of great interest. It was received along with other specimens by Mr. George C. Matson, of the United States Geological Survey, in 1911, and is recorded as having been found 1 mile west of Mulberry, Florida, in pit No. 7 of the Prairie Pebble Phosphate Co. Matson figured this bone[1] under the name "manatee." In the catalogue of the United States National Museum the specimen has received the number 7221. The fragment presents the hinder part of the right maxillary (pl. 1, figs. 1–3), extending from its articulation with the palatine forward to the front of the sockets for the anterior molar present. Near the front end, on the outer side of the bone, is a break which represents the base of the process which passed outward to join the malar bone. The maxilla is solid and heavy and has suffered little erosion. The fragment contains the hindermost molar tooth and the sockets, mostly filled by the roots, of three other molars. An examination of the specimen shows that it is closely related to the species which have been arranged under the genus *Metaxytherium*. The fragment of the maxilla (pl. 1, figs. 1–3) has a total length of 106 mm. The width at the middle of the penultimate molar is 40 mm.; the height at the same place, 39 mm. The whole base of the malar process is present and it had a fore-and-aft extent of about 44 mm. Its thickness was greatest behind and amounted to about 18 mm. Toward the front the process thinned out to a sharp edge.

As already stated, there were originally present four molars (pl. 1, fig. 3). The hindermost one is almost entire and is but little worn. Of the two immediately in front of it there are present only the roots; of the next one, only the sockets; and of the sockets of this molar only a part of the outer front one is present, the bone in front of it being gone. The total length of the tooth line was close to 85 mm. The first molar appears to have had its transverse axis turned so as to make an angle of about 45° with the tooth line, the inner end being turned backward so that the inner root is opposite the front and outer root of the second molar. From the outer border of the outer and hinder socket to the inner border of the inner socket is a distance of 22 mm. The roots of the second molar are present in their sockets. Evidently this tooth and the succeeding one were in the jaw when it was exhumed. This second molar has three roots, as the other molars, two outer ones and one inner. The distance across its outer sockets is 19 mm., that across the outer sockets of the third molar is 22 mm.; and this seems to have been the length of the crown of this tooth. The tooth appears to have had a width of about 25 mm. The roots of the hinder molar are large. The outer anterior is wholly hidden. The outer hinder root sent its extremity through the bone at a distance of 31 mm. from its base (pl. 1, fig. 2). The inner root is exposed nearly its whole length on the inner face of the bone (pl. 1, fig. 1). It has a length of 40 mm. and a diameter of about 13 mm. at its base.

---

[1] Bull. No. 604, U. S. Geol. Surv., pl. 12, figs. *A*, *B*.

The crown of the hinder molar has lost a little of its enamel in a few places; but the loss has not seriously injured it. Its length is 26.5 mm.; its width, 25 mm. It had only just begun to suffer wear. It presents essentially the characters of the genus *Metaxytherium*, as these have been expressed by Abel.[2] Figure 4 of plate 1 represents the tooth with the cones restored so as to show their positions.

The enamel of the tooth is strongely wrinkled. Running across the tooth about the middle of the length is a deep valley. Its course is not direct, but from the outer side it runs slightly forward in front of the metaconule and then swerves slightly backward as it passes to the inner side of the tooth. The valley is most widely open near its outer end, but it is narrowed at its immediate entrance by a little accessory conule attached to the base of the metacone. On the other hand, there are no accessory conules to block up the inner end of the valley, such as Abel has represented in his figure 17 on his page 149. The protocone, the protoconule, and the paracone stand in a straight transverse row. The paracone and the protoconule are very close to each other. The former is somewhat larger than the latter. The summit of the protocone is worn down and the probable shallow notch between it and the protoconule has been effaced. There is a large anterior talon; and, on the outer half of the crown, this is separated from the paracone and the protoconule by a wide and deep valley. The outer half of the talon is narrow and sharp, but it widens toward the lingual side of the tooth and becomes broadly confluent with the protocone. If there was originally a valley between the talon and the protocone, it has disappeared through wear.

---

[2] Abel, Abh. Geol. Reichsanst., Wien, vol. 19, Heft. 2, pp. 148–151.

The metaconule occupies a central position in the tooth, behind the transverse valley. It is closely connected with the hypocone, apparently less closely with the metacone. It exceeds the latter in size. In *M. krahuletzi*, according to Abel's figure, it is smaller than the metacone. The hypocone is large. At the rear of the tooth, closing the gap between the hypocone and the metacone, are two accessory conules, and there is another behind and outside of the hypocone. Bounded by these behind and by the hypocone, metaconule, and the metacone in front and at the sides, is a considerable pit. In the European species of *Metaxytherium* just mentioned this is filled with small accessory tubercles. The base of the tooth seems to be covered with a considerable coat of cement and this spreads upward in a thin layer on the crown, especially in the valleys.

This tooth differs from the teeth of all the species of *Metaxytherium* figured by Abel in being broader in proportion to its length.

Nothing is known about the abundance of this species. In collections made from the phosphate deposits about Charleston, South Carolina, portions of the skulls and limb bones of sirenians are not rare. They appear to belong to more than one species and probably to more than one genus. It is, however, at present impossible to correlate any skull bones or limb bones with the jaw above described.

It is impossible to determine with accuracy the geological age of this species. It belonged probably either to the Upper Miocene or to the Lower Pliocene. The European species belong to the Miocene or in part to the Oligocene. According to Sellards[3] the pebble phosphate beds at Mulberry rest on phosphatic marls of supposed Upper Oligocene age, and have been derived from the latter by reworking and concentration. The fossil here described is therefore probably residual from the parent formation, the Upper Oligocene.

From Mr. Charles T. Earle, there has been lately received a considerable lot of fossil bones and teeth which had been washed up on the beach at Palma Sola, Manatee County, Florida. Among these remains are teeth and bones of horses, camels, bisons, *Elephas columbi*, etc. These belong certainly to the Pleistocene. Other bones and teeth are present, which appear to belong to Miocene or Pliocene deposits. Such are teeth of *Carcharodon megalodon*, *C. auriculatus*, *Hemipristis serra*, *Lamna cuspidata*, a part of the beak of a platanisted porpoise, and a tooth of a sea cow. There are besides some bones of land tortoises and a part of a metapodial of a camel; but these may belong to the Pleistocene.

---

[3] Fla. Geol. Surv., vol. 7, pp. 52–84.

The sirenian tooth is of such a size and structure that it may well have belonged to the species of animal that possessed the upper jaw and teeth above named *Metaxytherium floridanum*. This tooth is apparently a lower right third molar, and it is well worn (pl. 1, fig. 5). The length is 25.5 mm. The width in front is 20 mm. There are present two well-preserved roots. The anterior occupies the width of the crown in front. On the outer side the cleft between it and the hinder root is somewhat behind the middle of the length; on the inner side, considerably farther in front. The hinder root is compressed from side to side. Unfortunately the enamel is much broken away from the outer face of the tooth and somewhat less from the inner face. At the front of the tooth there appears to have been a deep valley, which extended backward between the protoconid and the other elements of the front crest. This valley has been worn quite to its bottom. Evidently it limited posteriorly the strongly developed anterior cingulum.

There appears to have been an accessory cusp at the base of the metaconid, on its buccal side. The valley which separates the two principal crests is seen to extend half way across the tooth from the inner side.

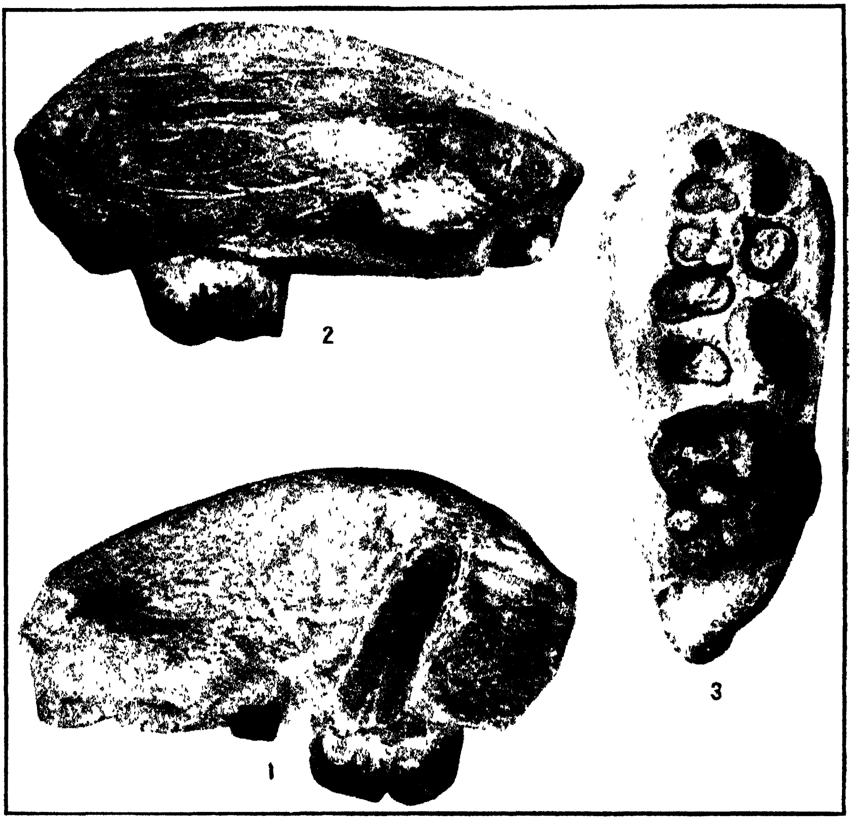
On account of the heavy wear there are not seen any remains of accessory cusps where the transverse valley opened out on the outer face of the tooth. For the same reason the exact structure of the hinder talon can not be determined by the writer; but this talon is well developed and there were two or three accessory conules.

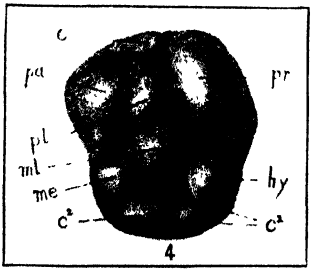
This tooth is provisionally referred to the species *Metaxytherium floridanum*.

EXPLANATION OF PLATE.

Metaxytherium floridanum, new species.

Figs. 1–3. Part of right side of upper jaw. ×3/4. Type.
1. View of lingual face.
2. View of buccal face.
3. View of alveolar face showing hindermost molar and the roots and sockets of three other teeth.
4. Hindermost molar restored. ×1. c^1, anterior cingulum; c^2, c^3, three conules belonging to hinder cingulum; *hy*, hypocone; *mc*, metacone; *ml*, metaconule; *pa*, paracone; *pl*, protoconulus; *pr*, protocone.
5. Lower right hindermost molar of a referred specimen. ×1.





METAXYTHERIUM FLORIDANUM, NEW SPECIES.

FOR DESCRIPTION OF PLATE SEE PAGE 4

NOTES ON CYNIPID WASPS, WITH DESCRIPTIONS OF NEW NORTH AMERICAN SPECIES.

By Lewis H. Weld,

Of the Bureau of Entomology, United States Department of Agriculture.

The present paper contains some miscellaneous notes on several species of both parasitic and gall-inhabiting Cynipidae, including some on synonymy and some generic transfers made as the result of a study of the Bassett and Osten Sacken types in the light of the Dalla Torre and Kieffer Monograph of 1910[1] and a study of the genotypes of the Ashmeadean genera.

In the course of a visit to Philadelphia and Cambridge in May, 1921, the writer saw several species belonging in the genus *Callirhytis* and related to certain species reared from acorn galls on which he was preparing another paper. An attempt was made to bring these related species all together in a key, and where sufficient material and biological data was available a few new species in this section of the genus are here described preliminary to a later paper.

The American fauna is peculiar in having several genera of apterous and subapterous forms which are no doubt the agamic generations of other genera. Few life histories have been worked out, however, and for the present it seems best to group these species as best we can into these genera. From a study of the genotypes two of these genera are here synonymized. On the other hand, two others, long united in literature, are here recognized as valid after a study of all the species in the light of a reëxamination of the genotypes. This separation received biological confirmation in the fact that the galls of the two genera are of quite different types Tentative keys are given for the determination of the adults and a new species is described in each genus. Whether these generic names will continue to be applied to these species groups when the life history and alternating generation of each species is known is not of present concern.

The paper is prepared under the general direction of Mr. S. A. Rohwer, custodian of Hymenoptera in the United States National Museum, where types of the five new species are deposited.

---

[1] Dalla Torre and Kieffer, Das Tierreich, Lief. 24, 1910.

IBALIA MACULIPENNIS Haldeman.

Plate 1.

Ibalia maculipennis Haldeman, Proc. Acad. Nat. Sci. Phila., vol. 3, 1846, p. 127.

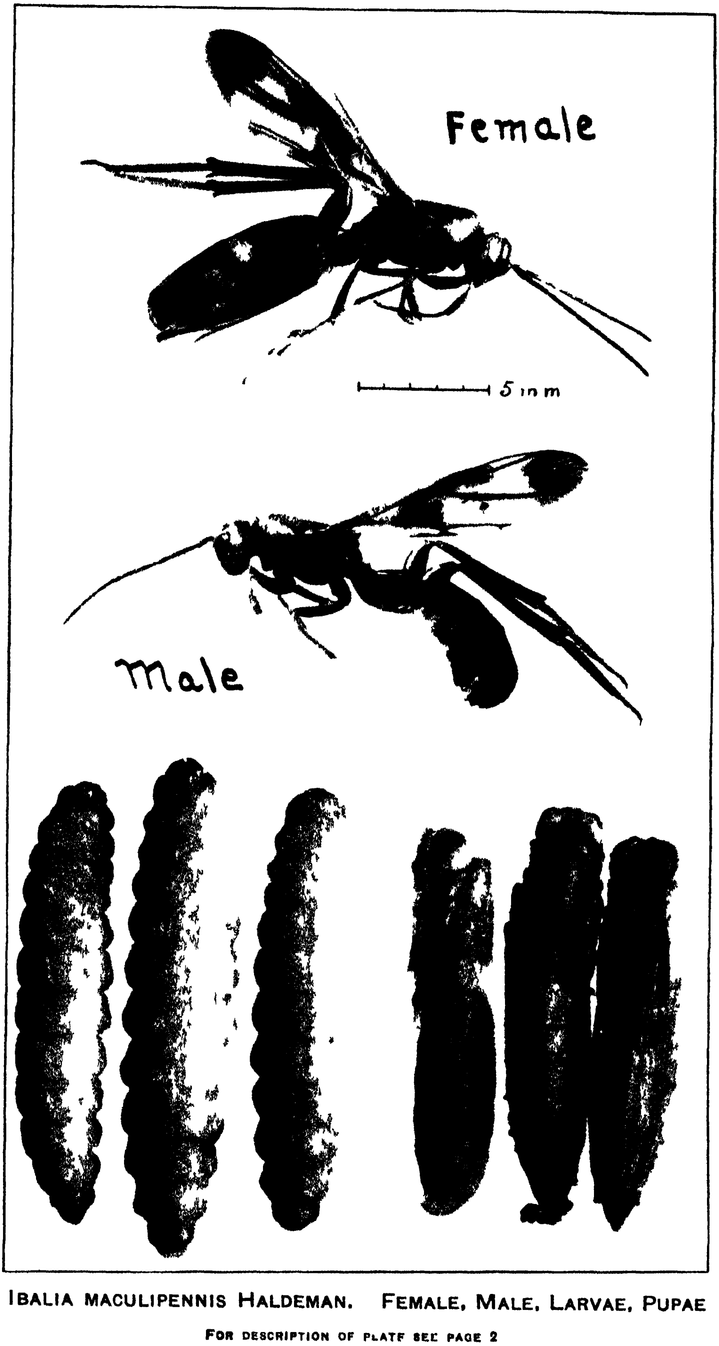
Ibalia fasciipennis Kieffer, Bull. Soc. Hist. Nat. Metz, vol. 26, 1909, p. 57.

Kieffer's *fasciipennis* was described from a single female from Wilmerding, Pennsylvania, collected by C. F. Baker, and the type was returned to Professor Baker, at Pomona College, where the writer has studied it and compared it with *maculipennis* and was not able to find any character to separate them. There appears to be but the one species in the deciduous forest area of the northeastern United States, and the writer concludes that *fasciipennis* is a synonym of *maculipennis*, which was also described from Pennsylvania. Haldeman's type of *maculipennis* is preserved in the Geneva Museum, and W. A. Schulz published a redescription of the species in 1912.[2]

The following notes record the writer's observations on this species: Five miles west of Evanston, Illinois, near the north branch of the Chicago River there stands on deep, rich, black loam an area of heavy forest of basswood, soft maple, ash, and elm, with considerable undergrowth. In this area of a few acres there were many standing dead hickory trees killed by bark beetles previous to 1913. On June 22, 1913, an insect was taken opivositing in one of these dead trees and recognized as belonging to this species. The next day a search was made for more and 25 were taken and the next day 50 more and 6 males and three days later 23 females and 2 males. On June 16, 1916, the trees were visited again and 10 females and 31 males taken; on July 4, 1917, 10 females and 1 male, and six days later 13 females; on June 12, 1919, found 11 females and 1 male, three days later 20 females and 7 males, three days later 2 females and 3 males, and on June 26, 4 females. A total of 221 females and 164 males were taken from this single locality during a period of seven years. These males and females probably occur in equal numbers, but the males are harder to capture. They are seen sunning themselves on the trunks of the dead trees, but are easily disturbed and fly to surrounding vegetation, from which they soon return. The females when ovipositing can all be picked off by hand at the first visit to the tree. Both are usually found within easy reach from the ground, and the majority of females oviposit within 2 feet of ground, where underbrush shades the base of the tree and the process of decay has reached a certain stage. As many as 23 have been taken on one tree at a single visit.

---

[2] Societas Entomologica, vol. 27, pp. 109–110.



IBALIA MACULIPENNIS HALDEMAN. FEMALE, MALE, LARVAE, PUPAE

FOR DESCRIPTION OF PLATE SEE PAGE 2

The ovipositor is from 25 to 28 mm. long and midway of its length about 0.052 mm. in diameter. The knife-like abdomen is thrust deeply into a crack in the outer bark and several attempts were made by clipping off the ovipositor and then boring a series of holes around the area and removing the block of wood to trace the further course of the ovipositor into the wood. It does not seem to be driven into the solid wood, but into a hole probably made by a horntail the midsummer before and which has become plugged up by a growth of sterile mycelium. When the horntail egg hatches the horntail larva eats a straight course toward the center of the tree, and one which had penetrated 3–5 mm. into the wood measured 1.2 mm. in length. As they advance, they molt frequently, and four or five cast larval skins were found in the first inch. The passage gradually enlarges as it goes deeper and the older parts become plugged with fungus. It is into this plug that the *Ibalia* ovipositor is thrust, and when the egg hatches the larva probably crawls along until it overtakes the horntail larva. How large the horntail larva has become and how far it has penetrated into the wood when attached is not known. Trees were visited about the middle of March one spring and nine horntail larvae were found about 50 mm. deep in the wood, measuring 6.5–10.5 mm. long and evidently from eggs laid the previous season. Seven *Ibalia* larvae were also found, 13.8–20 mm. long, apparently full grown, not near a horntail larva in any case, but in burrows they had evidently made for themselves. In similar burrows *Ibalia* pupae were found in June. Perhaps they make these burrows after they finish feeding. After transformation each *Ibalia* chews a hole through the wood and back to the exterior. The exit holes measure 3.0–3.4 mm. in diameter. The males begin to issue first. The earliest date of capture recorded on museum labels is June 1 in Pennsylvania and the latest is July 21 in Maine, the majority being taken in June.

The above series of specimens is probably the largest of any species of *Ibalia* or any other parasitic Cynipid ever studied, and measurements were made of the fresh specimens to the nearest tenth of a millimeter by optical methods. This series is supplemented by measurements of about 80 museum specimens, making a total of 480—280 females and 200 males.

Few studies of the variability of a parasitic insect are known to the writer. The above series seems sufficiently numerous to be representative of the species, so that it seems worth while to put on record the information that a study of the frequency distribution curve may yield regarding type and variation from it. Some individuals vary but little from the prevailing type, others more, and others still more. The following attempt to measure and record this nonconformity to type will be of most interest when it is possible to compare it with similar studies made on parasitic insects in other groups. This deviation is not so much to be regarded as a failure of heredity or a wandering from a fixed standard as a normal tendency of a species to vary, and of this inherent tendency biologists and systematists must take account. Some species may vary more than others, and by the use of the statistical method it is possible to derive and record considerable information concerning a species, information of a very different character from that usually given in descriptions and yet quite as fundamental as color, vestiture, or sculpture. The purpose of systematic entomology is to classify insects into groups of individuals known as species. But the present tendency is to describe the type specimen (an individual) implying that this description will fit other individuals of the group, then sometimes telling how the paratypes differ from the type and calling the result a description of a *species*, without mention of any species characteristics, such as range in size or any measures of prevailing type or variability, qualities which belong to the group as a whole and might serve to distinguish it from other related groups. The biometrical constants and frequency distribution curve are constant for the species and have the advantage of not being expressed in terms of any individual in the group.

In the accompanying graphs (fig. 1) the full line (for females) and the long and short dotted line (for males) represents the original data on the frequency distribution of the sizes of males and females plotted as ordinates, the measurements being grouped into half-millimeter classes and the abscissas taken from the mid-point of each class. By mathematical methods these ordinates have been graduated and the resulting smoothed curves represented by dotted (for females) and crossed (for males) lines. The computed constants are as follows:

	Males.	Females.
Range	9.2-15 7 mm	9.2-17.0 mm.
Mode	13. 25 mm	14 5 mm.
Median	13.195 mm	14.398 mm.
Mean	13.09 mm	14.239 mm.
Probable error or mean	±.047 mm	±.056 mm.
Standard deviation	.984 mm	1.393 mm.
Probable error of standard deviation	±.033 mm	±.040 mm.
Coefficient of variability	7.52%	9.78 %.
Probable error of coefficient of variability	±.25%	±.28%.

It will be seen that by any measure of prevailing type, the mode, median or mean, the females are somewhat larger than the males. The variability of the females is greater also. It is no greater, however, than that found in a gall-forming species[8] studied by the author. The tendency toward dwarfism in *Ibalia* must be considered, therefore, not as due to lack of food, but an expression of a normal tendency in the species to depart from the type. The best measure of this variability is the standard deviation which defined the shape of the frequency curve much as the radius defines a circle.

---

[8] Canad. Ent., vol. 51, 1919, pp. 254 5.

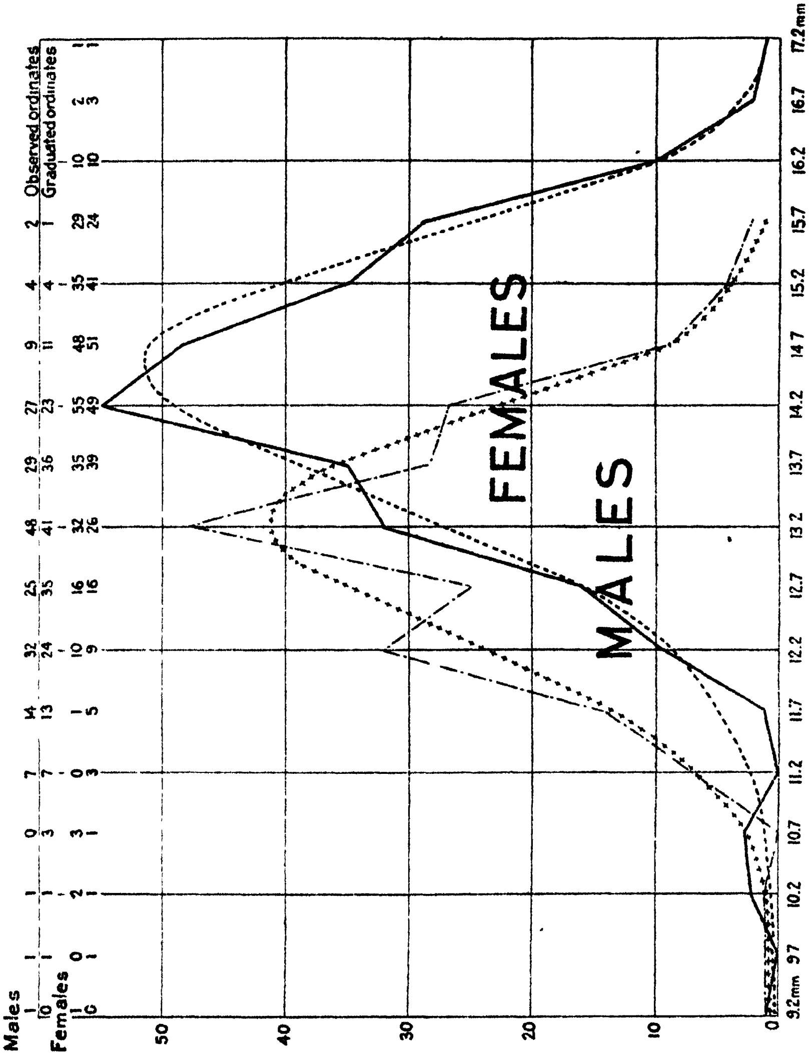


FIG. 1.—IBALIA MACULIPENNIS HALDEMAN. FREQUENCY DISTRIBUTION GRAPHS SHOWING SIZE OF 200 MALES AND 280 FEMALES. THE FULL AND LONG AND SHORT DOTTED LINES FROM OBSERVED DATA; THE DOTS AND CROSSES AFTER GRADUATING THE ORDINATES.

LIOPTERON TARSALE Ashmead.

The Academy of Natural Sciences, Philadelphia, has one female determined by the writer as this species by comparison with Ashmead's type. It is from Mexico, a locality from which the genus has not previously been recorded.

ANACHARIS LAMYI Cockerell.

Anacharis mexicana ASHMEAD (not *Megapelmus Mexicannus* Cameron 1884=*Anacharis mexicana* Cameron), Trans. Amer. Ent. Soc., vol. 23, 1896, p. 184.

Anacharis lamyi COCKERELL, Trans. Kansas Acad. Sci., vol. 16, 1899, p. 213.

Anacharis ashmeadi DALLA TORRE and KIEFFER in Wytsman Gen. Ins. Cynipidae, 1902, p. 14.

Not knowing that Cockerell had already changed the name of Ashmead's species, Dalla Torre and Kieffer in 1902 have erroneously given it the name of *ashmeadi*, which cannot stand.

LONCHIDIA HIRTA Provancher.

When studying the Provancher material in the collections at Quebec in 1915 in order to select lectotypes, Messrs. Gahan and Rohwer were unable to locate the type of this species. The only material the writer has ever seen determined as this species is a specimen in the United States National Museum bearing the label "Ontario," and a yellow label with the number "39," evidently sent out of the first collection by Provancher to Ashmead and labeled in Ashmead's hand "*Lonchidia hirta* Prov." The species was described from a female from Cap Rouge, Ontario. This specimen can be but a Provancher determination, and yet it is the most authentic material of the species known to be extant, so that it seems best to choose it as a lectotype. The size and shape of the radial cell agrees so closely with Dahlbom's figure of the wing of the genotype that *hirta* is left in *Lonchidia* in spite of the closed radial cell.

COTHONASPIS (ADIERIS) FLORIDANA (Ashmead).

Piezobria floridana ASHMEAD, Trans. Amer. Ent. Soc., vol. 23, 1896, p. 185.

In the Dalla Torre and Kieffer key (1910) the types of this species run to *Cothonaspis* (*Adieris*).

PSILODORA VAGABUNDA (Ashmead).

Kleidotoma vagabunda ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, pp. 298, 302.

Having a hairy ring at base of abdomen, the fore wing naked and nonciliate, the radial cell closed, and the disk of scutellum rounded behind, the type of this species goes in *Psilodora* rather than in *Erisphagia*, where Das Tierreich puts it.

DIPLOLEPIS BREVIPENNATA (Gillette).

Holcaspis brevipennata GILLETTE, Ent. News, vol. 4, 1893, p. 31.
Andricus pellucidus KINSEY, Bull. Amer. Mus. Nat. Hist., vol. 42, 1920, pp. 309–10, 384, pl. 23, figs. 19–21.

The type of *brevipennata* in the American Museum belongs in *Diplolepis* of the Dalla Torre and Kieffer monograph of 1910. It has the second tergite prolonged, the carina on propodeum angled, a transverse groove at base of scutellum, complete parapsidal grooves, and claws with a tooth. It goes in that section of the genus with spotted wings and is unique in having the wings reduced in size although not shorter than the abdomen, as maintained in the original description. The abdomen reaches two-thirds of the distance from the tip of radial cell to apex of wing, so the wing reaches slightly beyond tip of abdomen. The areolet is incomplete. The type locality Manitou, Colorado.

A. pellucidus was described from a similar gall from practically the same locality. The writer has seen cotypes kindly loaned by Doctor Kinsey and others in the Museum of Comparative Zoology and has been unable to separate them from *brevipennata*.

The United States National Museum has one specimen (Hopkins, U. S. No. 10781[1]) from Garden of the Gods, Colorado Springs, Colorado, reared November 20, 1918, which the writer has determined as this species. It issued normally and is in better condition than any of the above-mentioned type material. Its abdomen reaches to largest spot in apical area. The writer has one specimen cut alive out of a gall on November 9, 1917, the galls being collected on November 4. The writer has collected what seemed to be the galls of this species at Manitou, Trinidad, and Morley, Colorado; Las Vegas, Sandia Mountains, and Fierro, New Mexico; Williams and Prescott, Arizona; and Alpine, Texas.

DIPLOLEPIS SPLENDENS (Weld).

Andricus splendens WELD, Canad. Ent., vol. 51, 1919, pp. 254–5.

This species should be transferred to the genus *Diplolepis*.

DRYOCOSMUS FASCIATUS (Bassett).

Holcaspis fasciata BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 328.

This species has not at all the habitus of a *Disholcaspis*, the mesoscutum being bare, smooth, and shining, the parapsidal grooves complete, and the claws simple. It seems to belong in the genus *Dryscosmus*.

XYSTOTERAS POCULUM, new species.

Female.—Black. Head from above broader than thorax; length in median line half width, scarcely widened behind eyes; from in front as long as broad, interocular space 0.55 transfacial, and area higher than broad; malar space one-fourth eye; antennae 14-segmented; lengths as (pedicel) 12:9:14:11:9:9:8:8:8:7:7:6:6:8; palpi 5 and 3 segmented; the basal maxillary and middle labial segments very short; sides of pronotum and mesopleurae smooth. Mesoscutum smooth and shining with about 25 scattered hairs on parapsides; parapsidal grooves absent or faint in middle and obliterated at each end. Scutellum disk smooth, rounded behind, clothed with sparse hairs; base with narrow transverse groove without pits. Propodeum slightly rugose in place of usual carinae. Wings not reaching abdomen. Hind tarsus longer than tibia; claws with weak tooth at base. Abdomen longer than head and thorax, in side view longer than high, compressed to less than width of thorax; the second tergite longest, occupying 0.28 of the length of abdomen; the others all visible and gradually decreasing in length; ventral valves oblique, but not protruding; ventral spine in side view six times as long as broad. Ovipositor hooked at end. Using width of head as a base, the length of mesonotum ratio is 0.75; antenna, 2.04; ovipositor, 5.8; wing, 0.5.

Length of 36 pinned specimens, 1.5–2.3 mm.; average 1.9 mm.

This species is closely related to *Acraspis politus* Bassett, which is a *Xystoteras*.

Type.—Cat. No. 24732, U.S.N.M. Thirty cotypes.

Host.—*Quercus alba.*

Galls.—Popularly known as "spangle" galls and first described by Fitch in 1859, these common objects have an extended literature under the name of *Cecidomyia poculum*, with good figures by Glover, Beutenmueller, Stewart, Thompson, and Felt, but they have not hitherto been reared. Osten Sacken suspected that they were due to a Cynipid.

The galls are attached in groups on the underside of mature leaves, and they are found in September and October. They are button-shaped, 3–4.5 mm. in diameter, covered with a whitish bloom, slightly concave above, with a low elevation in center, the edge sharp and becoming less upturned as the larval cavity develops, attached by a short slender pedicel, between which and the rim on the under side is a prominent heavy rounded ring of tissue. The larval cavity is centrally placed, transverse, with no false chamber.

Habitat.—The type material was collected at Ironton, Missouri, on October 5, 1917, and living flies were found in the out-of-door breeding cage at Evanston, Illinois, on March 24, 1919, indicating that the emergence is very early the second spring. This delayed emergence probably accounts for the failure of other students to rear it.

The writer has seen these galls in Virginia, New York, and Illinois also and museum specimens from Vermont and New-Hampshire, indicating a widespread distribution of the species.

There is a precisely similar gall in *Q. prinus*, which will no doubt prove to be due to this species.

Genus ZOPHEROTERAS Ashmead.

Zopheroteras ASHMEAD, Canad. Ent., vol. 29, 1897, p. 261. Genotype.—*Acraspis vaccinii* Ashmead.

Parateras ASHMEAD, Canad. Ent., vol. 29, 1897, p. 262. Genotype.—*Parateras hubbardi* Ashmead.

Parateras hubbardi Ashmead was described from two specimens from Detroit, "nothing known regarding habits." One of these is in the United States National Museum. Its hind tarsi are *shorter* (not longer) than their tibiae in the proportion of 50:59, and the tarsal claws are *simple* (not toothed). In both respects it does not differ from the type of *vaccinii*. In *vacinii* the third joint of the antenna was said to be "as long or nearly as long as joints 4 and 5 united," but a balsam mount shows the length of the first seven segments to be as 13:8:19:13:11:10:9, so that the third is distinctly shorter than 4 plus 5, and in this respect it does not differ from *hubbardi*. Both have the same type of scutellum, the second tergite occupying slightly over six-tenths of abdomen, the same type of ventral spine, the head not broadened behind the eyes, malar space less than half eye, the parapsidal grooves strongly converging behind, and both are entirely wingless. Therefore *hubbardi* seems to be congeneric with *vaccinii* and *Parateras* a synonym of *Zopheroteras*.

The species *vacinii* was described from a "huckleberry-like" gall in clusters on midrib of post oak, dropping to ground in fall, and the type galls answer this description. They are evidently galls of a winged species which Beutenmueller has described as *Andricus impositus*. In picking up galls Ashmead evidently picked up a few of a different sort, from which he rearer two wingless flies, which he called *vaccinii*, and associated them with the wrong gall. The gall of this *Zopheroteras* is then still undescribed.

The gall of *hubbardi* is still unknown. The writer has seen one fly which he has determined as that species by comparison with the type from Bladensburg, Maryland, captured April 8, 1915, by L. O. Jackson, and another from Bellmore, Long Island, collected by G. P. Englehardt.

Dalla Torre and Kieffer are apparently in error in making *Zopheroteras* a synonym of *Trigonaspis*. It does not seem at all related to the European wingless form, *Trigonaspis megaptera* (Panzer).

NOTES ON PHILONIX FITCH AND ACRASPIS MAYR.

The genus *Philonix* Fitch was proposed in 1859 for two apterous species of Cynipidae, *fulvicollis* Fitch [4] and *nigricollis* Fitch, captured on snow. Ashmead [5] subsequently designated *fulvicollis* as the type, and Dalla Torre and Kieffer [6] placed the genotype in *Biorhiza.* A study of Fitch's type of *fulvicollis* in the United States National Museum shows a scutellum which is normally rounded behind and a very peculiar spine broadest at its truncated posterior end, which is armed with long bristles. No flies reared from a known gall are at hand which agree with this specimen, so the gall of this species is yet to be discovered. Fitch thought it was from a root gall, but more likely it is from a deciduous gall on a leaf. The illustration showing these characters is from a balsam mount of a congeneric new species here described.

The genus *Acraspis* Mayr [7] was proposed in 1881 for two American species which he no doubt had before him, "*pezomachoides* Osten Sacken and *erinacei* Walsh" and which he did not separate by any mentioned characters. The former species, whose gall had long been known in literature under the name of *Cynips pisum*, was reared in 1862 and described as *Cynips pezomachoides* Osten Sacken. The latter was a *nomen nudum* for the gall only for the fly was not described at the time Mayr wrote, although he no doubt considered it as a valid Ashmead synonomized *Acraspis* with *Philonix*, and Beutenmueller [8] Osten Sacken as the type of *Acraspis.* In 1897, and again in 1903, Ashmead synonomized *Acraspis with Philonix*, and Beutenmueller [8] and other authors have followed him. In *pezomachoides*, however, the scutellum is triangular, distinctly pointed behind, and the ventral spine, while broader and shorter than in most genera of the oak-gall makers, is rounded behind and very hairy, not truncate with the very long bristles of *Philonix.* These seem to be sufficiently good generic characters to warrant the separation of these genera which Ashmead united. When the described species of these two genera were studied with these characters in mind, it was found that *fulvicollis* Fitch, *nigricollis* Fitch, *lanaeglobuli* Ashmead, and *nigra* (Gillette) (=*gillettei* Bassett) belong in *Philonix*, while *pezomachoides* (Osten Sacken), *villosa* Gillette, *macrocarpae* Bassett (=*undulata* Gillette), *hirta* (Bassett), *echini* Ashmead, *erinacei* Beutenmueller, and *prinoides* Beutenmueller belong in *Acraspis.*

This arrangement receives biological confirmation in the fact that the galls of all the species of *Acraspis* are all of the same general type, known by such common names as "pea," "hedgehog," "spiny oak gall," being hard globular or elongated galls attached to the surface of the leaf, reticulate on the outside or rough with points or spines and containing one, two, or several larval chambers without an inner cell. The flies emerge late in the fall, usually before the leaves drop (and in one known instance oviposit at once in the buds), the galls remaining attached to the leaves and dropping with them. The only *Philonix* galls known are of quite a different type. They are fleshy, globular, slightly attached to the under surface of the leaf, with a thick pithy wall covered with a short dense felt-like pubescence looking as though it had been rolled in road dust. Inside there is a single thin inner cell surrounded and supported by a dense layer of dark-brown radiating fibers. They drop to the ground in September and October long before the leaves, and some larvae transform into adults which emerge later the same season in November and December and others not until the next spring. Other larvae do not transform

---

[4] Fifth Rept. Nox. Ins. N. Y., 1859, p. 783.

[5] Psyche, vol. 10, 1903, p. 148.

[6] Das Tierreich, Lief. 24, 1910, p. 402.

[7] Genera gallenbew. Cynip, 1881, pp. 2, 29.

[8] Bull. Amer. Mus. Nat. Hist., vol. 26, 1909, p. 246.

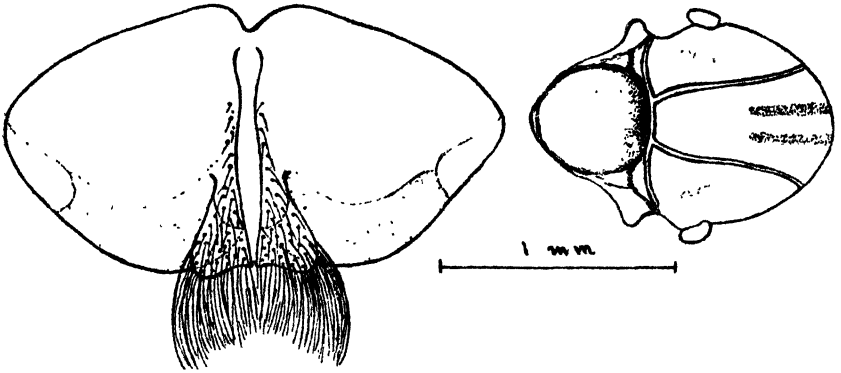


Fig. 2.—Philonix gigas, new species. Hypopygium and mesonotum.

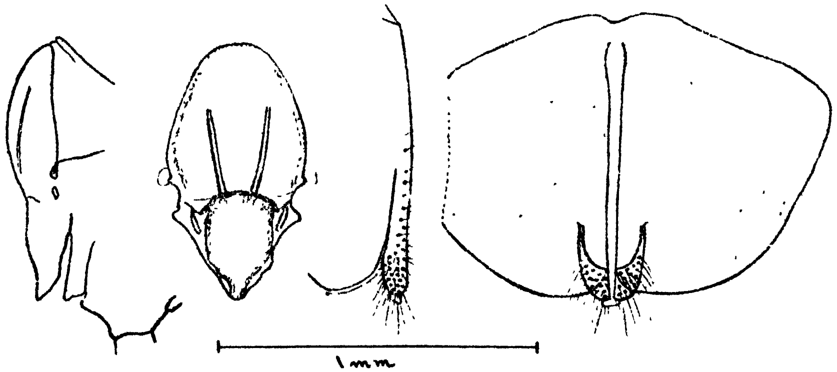


Fig. 3.—Acraspis pezomachoides (Osten Sacken). Dorsal and side views of mesonotum and hypopygium.

until the second or third fall. Habits of oviposition unknown. The known species of both genera are found only on the white oaks. Tentative keys for the separation of the species in each genus are here presented together with descriptions of two new species.

SEPARATION OF PHILONIX AND ACRASPIS.

Both genera include only agamic females with rudimentary wings and a scutellum of normal length and size, the third segment of antenna always longer than the fourth.

Scutellum normally rounded behind. Ventral spine truncate, broadest at apex, nearly flat and armed with long bristles. Fig. 2 .... **Philonix.**

Scutellum tapering to a point behind and hence triangular. Ventral spine short, stout, rounded behind and hairy; more slender and trough-shaped than normal. Fig. 3 .... **Acraspis.**

KEY TO DESCRIBED SPECIES OF PHILONIX.

1. Fore wing not over 3.75 times as long as broad but reaching back beyond the second tergite and with typical venation outlined except for areolet. *Q. lyrata* .... **gigas**, new species.

Fore wing more lanceolate, at least four times as long as broad, not reaching to hind margin of second tergiate, with only subcosta and first cross-vein distinct, radial cell seldom suggested .... 2.

2. Interocular area square. Wing ratio less than 1.0 (wing length less than width of head), broadest behind middle and end rounded. 3.75 mm. New York. Gall unknown .... **nigricollis** Fitch.

Interocular area broader than high (ratio 1.1). Wing ratio at least 1.2 .... 3.

3. Dark-colored species, abdomen nearly black. Mesoscutum with a median polished and nearly bare spot. Eastern United States. *Q. alba.* **nigra** (Gillette) (=**gillettei** Bassett).

Light-colored species, abdomen slightly infuscated. Pubescence on mesoscutum uniform, no polished bare spot .... 4.

4. Hind tarsus longer than tibia. Under 3.75 mm. Gall unknown. New York. **fulvicollis** Fitch.

Hind tarsus equal to tibia. 4.8 mm. *Q. bicolor.* Florida. **lanaeglobuli** Ashmead.

PHILONIX GIGAS, new species.

Agamic female.—Head, legs, and thorax reddish-brown, more or less infuscated, and clothed except on frons with silvery pubescence; abdomen black, red at tip. Head coriaceous, broader than thorax, broadened behind eyes; interocular space 0.57 transfacial and area 1.2 times as broad as high; malar space 0.4 eye and without groove; antennae 14-segmented; lengths as 21:10:32:27:20:18:5:14:12:11:10:10:10:18. Mandibles 2-toothed; palpi 5 and 3 segmented. Mesoscutum broader than long, smooth with uniformly distributed setigerous punctures; parapsidal grooves narrow, deep, smooth, percurrent, almost straight, well separated behind; anterior and lateral lines represented only by infuscations. Scutellum disk circular, slightly rugose behind, arcuate furrow at base. Propodeum smooth except on rugose neck; usual carinae not developed. Mesopleurae smooth and pubescent. Hind leg with femur stouter than coxa;

tibia longer than tarsus, second shorter than fifth; claw with large tooth. Fore wing reduced, reaching beyond second tergite, about 3.5 times as long as broad; venation normal but without areolet; surface pubescent; margin ciliate. Abdomen smooth, polished, longer than head and thorox, longer than high, somewhat compressed; second tergite occupying 0.6 with large white pubescent areas reaching its hind margin on sides. Ventral spine truncate, broadest at apex, very hairy; ovipositor when dissected out a little longer than antenna. Using width of head as a base, the length of mesonotum ratio is 0.96; antenna, 2.5; ovipositor, 2.8; wing, 1.85.

Range in length of 19 pinned specimens, 2.8–4.9 mm.; average, 3.9 mm.

Closest to *lanaeglobuli* Ashmead, a lighter colored species, whose wing does not reach middle of second tergite and whose venation is far less complete.

Type.—Cat. No. 24679, U.S.N.M. Type and 15 paratypes.

Host.—*Quercus lyrata.*

Gall.—Globular, 15–20 mm. in diameter, produced on the under side of leaves and dropping to the ground in the fall. In appearance and structure they resemble the much smaller galls of *Philonix nigra* (Gillette).

Habitat.—The type galls were collected at Hoxie, Arkansas. Seven flies emerged December 1, 1917; three December 18, 1917; and two March 24, 1919. From galls collected at Poplar Bluff, Missouri, three adults were cut out November 16, 1917.

KEY TO DESCRIBED SPECIES OF ACRASPIS.

1. Sides of all the tergites pubescent, a narrow median dorsal stripe bare----2.
   Pubescence on abdomen confined to usual patches on sides of second tergite or at most to second and third----5.
2. Mesonotum at least as long as width of head (ratio 1.0). Hind tarsus shorter than tibia. Wing broadest in distal half----3.
   Mesonotum length 0.85–0.90 width of head. Hind tarsus as long or longer than tibia. Wing lanceolate not distinctly wider in distal half----4.
3. Wing more than twice as long as scutellum, longer than width of head. Segment 3 of antenna not longer than 1 and 2. Lateral lines bare and shining. Colorado----**alaria**, new species.
   Wing less than twice scutellum, not as long as width of head. Segment 3 of antenna longer than 1 and 2. Mesoscutum uniformly pubescent, lateral lines not bare of shining----**villosa** Gillette.
4. Mesoscutum length not over 0.9 width of head. Propodeum without a median carina. Pubescence between parapsides denser than on adjacent scutellum. Parapsidal grooves distinct but short. Disk rugose behind. *Q. macrocarpa.*
   macrocarpa Bassett (=**undulata** Gillette).
   Mesoscutum ratio over 0.9. Propodeum with a median carina. Pubescence between parapsides as sparse as in base of scutellum. Parapsidal grooves very fine and short. Disk coriaceous behind. Gall on chestnut oaks.
   hirta (Bassett).

5. Hind tarsus shorter than tibia. Scutellum not over-hanging metanotum, its apical portion triangular in profile and slightly upturned. Mesoscutum with uniformly distributed short pubescence. *Q. prinoides.*
prinoides (Beutenmueller).

Hind tarsus as long or longer than tibia. Scutellum overhanging metanotum, its apical portion not upturned but directed straight backward. Mesoscutum almost bare between parapsides behind ---------------------------------- 6.

6. Parapsidal grooves precurrent. Wing at least twice as long as scutellum. *Q. bicolor,* Florida ---------------------------------- echini Ashmead.

Parapsidal grooves not quite reaching front margin. Wing not twice length of scutellum ---------------------------------- 7.

7. Low median ridge from median ocellus to antennae. *Q. alba.*
erinacei Beutenmueller.

Front without median ridge ---------------------------------- pezomachoides (Osten Sacken).

ACRASPIS ALARIA, new species.

Agamic female.—Reddish-brown with clypeus to occiput; antennae, propodeum, abdomen except sides of second tergite deeply infuscated to black. Interocular space 0.58 transfacial and area 1.27 times as broad as high. Malar space, 0.47 eye. Antennae, 14-segmented; length as 18:9:24:21:16:14:12:11:9:9:8:8:7:14. Palpi 3 and 5 segmented; last very stout. Sides of propodeum finely rugose. Mesonotum 1.6 times as long as broad; mesoscutum as long as broad; the lateral lines bare and polished; parapsidal grooves very short, obliterated at both ends; pubescence more sparse between parapsides and surface often shining. Scutellum margined; not as sharply triangular behind as in some species. Propodeum rugose between the usual carinae. Hind coxa not as stout as femur; tarsus shorter than tibia. All claws with stout teeth. Fore wing broad; width one-third length, broadest in distal half, over twice as long as scutellum, reaching middle of second tergite; only subcosta and first abscissa of radius developed. Abdomen about 0.6 length of body; second tergite making up 0.6; lengths of tergites 2–4 as 82:23:6. Sides of all tergites pubescent, with narrow median dorsal base space, which is broader on second tergite and deeply indents the pubescent patches on its sides. Using width of head as a base the length of mesonotum ratio is 1.06; wing, 1.1; antenna, 2.5; ovipositor, 2.24. Range in size of 14 pinned specimens, 2.5–3.5 mm.; average 3.1 mm.

Type.—Cat. No. 24680, U.S.N.M. Twelve cotypes.

Host.—*Quercus gambelii.*

Gall.—Similar to that of *Acraspis villosa* Gillette. Straw-yellow; 9–11 mm. in diameter, covered with a large 1 mm. deep of closely packed conical projections, each ending in a bristle a little over 1 mm. long. Monothalamous, the central larval cell 3 mm. in diameter. Single, attached to midrib; exit hole close to point of attachment. Occurs in fall.

Type locality.—Colorado Springs, Colorado. Galls collected November 4, 1918, by Mr. J. H. Pollock and sent in under Hopkins U. S. No. 10773^x. One fly reared November 11, 1918, others found alive in cage January 15, 1919.

ANDRICUS CINNAMOMEUS Ashmead.

Andricus cinnamomeus ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, 1887, p. 137.

Andricus calycicola ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, 1887, p. 141.

A. calycicola was described as producing two types of galls on *Q. laurifolia*, one inside of buds and one in an aborted acorn cup. The type fly and gall as labeled by Ashmead and agreeing with his description are quite obviously the same as *cinnamomeus*, of which the United States National Museum has nine type flies and whose bud gall is produced on *Q. chapmani.* The writer has collected it at St. Petersburg, Daytona, and Ocala, Florida, and reared the fly which agrees with the types.

The acorn gall and fly belong to *Callirhytis.* The gall is one of those which develops by the side of young acorns and then drops to the ground. As there is only one fly, without a head, in the collection no attempt is here made to determine or describe it.

ANDRICUS FORMOSUS (Bassett).

Cynips formosa BASSETT, Proc. Ent. Soc. Phila., vol. 3, 1864, p. 679.

Cynips capsuala ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, Proc. p. 9.

C. formosa was described from Waterbury, Connecticut, as forming a very rare gall on *Q. rubra.* The United States National Museum has a type fly and gall from Bassett. *C. capsuala* was described from *Q. cinerea* and *Q. catesbaei* from Florida, and the museum has two type flies which agree with the type material of *formosa.*

The writer collected these galls on the ground at Jacksonville, Florida, April 4, 1914, under *Q. phellos.* When a few were opened the middle of the next November, both pupae and adults were found. Flies emerged in breeding cage by February 24, 1915, and more came out February 15, April 15, and May 6, 1916, taking two years to emerge. This gall seems to be produced on *Q. laurifolia*, also in Florida. The writer has found old galls under tree of *Q. imbricaria* at Poplar Bluff, Missouri; under *Q. texana* at Boerne, Texas; and fresh growing clusters of galls on *Q. coccinea* at Miller, Indiana; Fort Sheridan, Illinois; and East Falls Church, Virginia. It seems to be common in the south and rare in the north, where it occurs on other host oaks.

ANDRICUS FURNESSAE (Weld).

Callirhytis furnessae WELD Insect. Insit. Menst., vol. 1, 1913, pp. 132–3.

As the tarsal claw has a distinct tooth, this species should be transferred to the genus *Andricus*, following Dalla Torre and Kieffer instead of Ashmead.

ANDRICUS PETIOLICOLA (Bassett).

Cynips petiolicola BASSETT, Proc. Ent. Soc., Phila., vol. 2, 1863, p. 325.

Andricus quinqueseptum ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, p. 299.

Andricus cicatricula BASSETT, Trans. Amer. Ent. Soc., vol. 17, 1890, p. 80.

Andricus concolorans KINSEY, Bull. Amer. Mus. Nat. Hist., vol. 42, 1920, pp. 302–4, pl. 22, figs. 12–13.

The species *quinqueseptum* was described from "12 specimens bred in July," said to be males. Two specimens were found in the United States National Museum labeled as this species. No others have been seen in other museums. The one in the old "museum collection," labeled by Ashmead as the type, belongs to another genus, and the one in the Ashmead collection agrees with the description of the species, although it is a female, and this specimen was elected as the holotype in July, 1921. As the antennae are described as 14-segmented, it is probable that the use of the sign for "male" in the original description was a typographic error. This fly agrees with specimens of *petiolicola*, and the gall confirms the idea that they are the same species, although it is slightly different in shape and occurs on the post oak.

The writer studied the Bassett types of *citratricula* in the Academy of Natural Sciences, Philadelphia, and found he was unable to distinguish them from the Bassett types of *petiolicola*, and the six type galls of *cicatricula* on *alba* are similar to those of *petiolicola* on *prinus*.

Dr. A. C. Kinsey recently studied the "type material of Bassett's *Andricus cicatriculus* in the American Museum of Natural History" and says that it "contains one female of *A. concolorans* and a number of specimens of an inquiline. The description of the adult *cicatriculus* agrees with the inquiline, to which the name must be applied; it would appear to be a *Ceroptres*." The writer examined this material in June, 1921, and supplemented this with a study of the type material of *cicatricula* in other museums. It was Bassett's custom to put in his pill boxes all the material bred, including parasites and inquilines, and from this box sendings were made (unmounted and unsorted) to his correspondents with the name of the species written on the cover and "types," if such was the case. An examination of all the available sources shows that in this case it consisted of four species as follows:

	(a)	(b)	(c)	(d)
American Museum Natural History	1 female	1 female, 2 males	1	
Academy Natural Science, Philadelphia	1 male	56 females, 18 males	1	1
United States National Museum		5 females, 9 males		1
	2	91	2	2

Species (*a*) is a rare find congeneric with a species on which Ashmead founded the genus *Euceroptres*, a guest genus distinct in the writer's opinion from *Ceroptres*. It was not recognized by Doctor Kinsey. Bassett's description of *cicatricula* does not apply to this species.

Species (*b*) is Bassett's *cicatricula*, to which his description does apply. It is a true gall maker, with the pronotum "narrow" in middle. It vastly outnumbers all the others.

Species (*c*) is determined by the writer as *Callirhytis tumifica* (Osten Sacken) from an accidentally included and unnoticed gall somewhat similar in shape on a red oak and yielding flies at about the same time. Bassett's description does not apply to this. This is presumably the "single (undescribed) female of the Bassett types" in the American Museum, and it was in the row the first specimen of which was labeled *concolorans*.

Species (*d*) is also a *Callirhytis*, but unknown to the writer, and he will not describe it. Bassett's description does not apply to this. It must have issued from another unnoticed gall.

Doctor Kinsey has transferred Bassett's *cicatricula*, which is a true gall maker, to the genus *Ceroptres*, where it does not belong. Then he has taken a large series of *cicatricula* from the Thompson collection, and under the mistaken impression that it matched the single female (*c*) in the American Museum has redescribed the species under the name of *concolorans*, which becomes a synonym of *circatricula*. All type material of *concolorans* seen by writer consists of material from the Thompson collection only and agrees with types of *cicatricula*. The figures of the galls of *concolorans* on *alba* seem to be like the types of *cicatricula*. The conclusion is that we have here just one species which ranges throughout the eastern half of the United States and forms galls on several white oaks.

The writer has reared flies from galls on *Quercus michauxii* from Ocala, Florida, an oak not previously recorded as a host of this species.

ANDRICUS VERNUS (Bassett).

Amphibolips verna BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 321.

This species was described from a single specimen taken April 9 ovipositing in bud of *Q. ilicifolia*. It is an *Andricus*.

CALLIRHYTIS BADIA (Bassett).

Amphibolips badius BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 323.

Callirhytis corallosa WELD, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 216, pl. 32, figs. 16, 17.

While studying the Bassett collection at Philadelphia in May, 1921, the writer suspected that the type of *Amphibolips badius* Bassett described from an unknown gall was the same as *Callirhytis corallosa*

Weld. Later Mr. S. A. Rohwer kindly took a type of *corallosa* to Philadelphia and made a direct comparison and confirmed this suspicion, so that the name of *badia* must now be applied to the flies and gall recently described as *corallosa*. This discovery adds the further information to the life history that the fly of this root-gall-forming species emerges in "early spring" and oviposits in the buds of thrifty white oak sprouts, but the alternating generation is at present unknown.

CALLIRHYTIS BIGNELLI (Dalla Torre).

Trisolenia punctata ASHMEAD, Proc. U. S. Nat. Mus., vol. 19, 1896, pp. 129–130.

Andricus bignelli DALLA TORRE in Wytsman Gen. Ins. Cynipidae, 1902, p. 61.

Amphibolips montana BEUTENMUELLER, Insect Insit. Menst., vol. 1, 1913, p. 122.

The type of *montana* is in the collection of William Beutenmueller, who also has another specimen of the same species loaned to the writer for study in June, 1921. This agrees with the Ashmead type of *punctata* which Dalla Torre renamed *bignelli*.

CALLIRHYTIS CONGREGATA (Ashmead).

Andricus congregatus ASHMEAD, Proc. U. S. Nat. Mus., vol 19, 1896, p. 120

The following notes are made from the seven type females in the United States National Museum. The four with unbroken antennae show 15 segments. The sides of pronotum are slightly reticulate; mesoscutum coriaceous, as long as broad, parapsidal grooves complete. Transverse groove at base of scutellum scarcely divided into distinct pits. Carinae on propodeum bent outward. Fore wing short brown pubescent; the hairs on hind margin slightly longer than those on surface, but much shorter than normal cilia. Venation complete; areolet distinct; cubitus reaching basal below middle. Claws weak and simple. Abdomen higher than long, shorter than head and thorax; ventral spine not longer than broad. Using width of head as a base, the length of the mesoscutum ratio is 1.22, antenna, 2.08; ovipositor, 5.25; wing, 3.2. It is a *Callirhytis* related to those other species of this genus bred from flower galls. In the collection there are also two males, which are undescribed.

Male.—Similar to female in color and sculpture. Antennae 16-segmented, wings normally ciliate; abdomen triangular, shorter than thorax. Length 1.7–1.8 mm.

The writer has collected galls of this species at Los Angeles, Pasadena, Santa Anita, Camp Baldy, Newhall, Piru, in Ojai Valley, Carpinteria, Montecito, Santa Barbara, Santa Margarita, Paso Robles, Soledad, Monterey, Los Gatos, Palo Alto, Mount Tamalpais, back of Berkley, at Bagby, and St. Helena, California. They do not occur on *Q. chrysolepis*, as Ashmead stated, but on *Q. wislizeni* and *Q. agrifolia*. *Q. chrysolepis*, and *Q. agrifolia* have no galls in common; *wislizeni* and *agrifolia* have many. The new galls start in early April and are full grown by early May. While growing rapidly they secrete honey-dew.

CALLIRHYTIS CRYPTICA, new species.

Female.—Dark reddish-brown. Head coriaceous. Interocular space, 0.5 transfacial, and area 1.25 times as broad as high. Malar space, 0.5 eye, with striae. Antennae slender, 13-segmented; lengths as (pedicel) 13:6:11:12:11:11:10:9:8:7:7:7:14. Sides of pronotum coriaceous. Mesoscutum broader than long; coriaceous. parapsidal grooves deep and complete, median reaching forward nearly half-way. Scutellum coriaceous; usual pits oval, smooth, very oblique, separated by a septum wider than a pit. Median area on metanotum as broad as the area on propodeum between the carinae, these carinae nearly parallel inclosing a smooth area broader than long. Veins of fore wings obliterated beyond second cross-vein, others pale; no areolet; surface short pubescent; margin not ciliate. Hind tarsus as long as tibia; claws simple. Abdomen shorter than head and thorax, broader than long in side view, with interrupted ring of wool at base. only tergites 2 and 3 showing dorsally; ventral valves not conspicuous; ventral spine very long and slender, twice as long as hind matatarsus; this character hard to see in pinned specimen. Ovipositor hooked at end. Using width of head as a base, the length of mesonotum ratio is 1.09; antenna, 2.6; ovipositor, 4. 0; wing, 3.5.

Range in length of eight specimens, 1.9–2.1 mm., average 2 mm.

Type.—Cat. No. 24725, U.S.N.M. Type and six paratypes.

Host.—*Quercus falcata* and *Quercus myrtifolia*.

Gall.—A bud gall found in October. The affected bud in terminal cluster becomes enlarged, leaf rudiments are protruded beyond the bud scales, and then the whole thing turns brown, although one or two green leaves sometimes grow out of this seemingly dead bud. Completely hidden within is an axial, conical, thin-walled cell with a tuft of hairs near apex, filling the whole interior of bud. It somewhat resembles the gall of *Andricus cinnamomeus* Ashmead, which is also within a swollen bud but on *Q. chapmani*. Its covering of bud scales is intact, and within is a central cavity, on one wall of which is the larval cell, which is therefore eccentric instead of axial.

Habitat.—The type galls were collected at Dothan, Alabama, on *Q. falcata*, October 8, 1919. Flies issued May 1 and May 23, 1920. These galls were seen also at Cottondale, Florida. At Carrabelle and at Ocala, Florida, they were collected on *Q. myrtifolia* and one fly found dead in the cage the next May. The species pupates in December, the adults remaining in the galls until the next spring.

CALLIRHYTIS FLORA, new species.

Female.—Reddish-brown; abdomen nearly black posteriorly. Head coriaceous. Interocular space 0.58 transfacial and area 1.3 times as broad as high. Malar space 0.5 eye, with groove. Antennae slender, 14-segmented, lengths as (pedicel) 13:5:12:10:9:8:7:6:6:6:6:6:6:10. Sides of pronotum rugose. Mesoscutum broader than long; slightly rugose behind between parapsides; parapsidal grooves complete. Scutellum coarsely rugose, not margined, with two indistinct rugose pits at base. Carinae on propodeum bent slightly outward; spiracular areas smooth. Fore wing with normal brown venation; both cross veins clouded and areolet reaching about one-sixth way to basal; surface short brown pubescent; margin not ciliate. Hind tarsus shorter than tibia; tarsal claws weak, simple. Abdomen shorter than head and thorax, as broad as long; all tergites visible on dorsal margin; ventral valves almost vertical; ventral spine scarcely as long as broad; ovipositor exserted. Using width of head as a base, the length of mesonotum ratio is 1.1; antenna, 1.2; wing, 3.2; ovipositor, 9.3.

Range in length of 10 specimens, 1.5–2.3 mm.; average, 2 mm.

Type.—Cat. No. 24726, U.S.N.M. Type and seven paratypes.

Host.—*Quercus wislizeni.*

Gall.—An abrupt smooth and polished swelling of the midrib on the under side at the base of the leaf blade and rarely extending half the length of the leaf, 10–30 mm. long by 6–9 mm. in diameter; polythalamous, hard.

Habitat.—The type locality is Mount Tamalpais, Marin County, California, where galls were collected May 25, 1918. Galls were also collected at Camp Baldy June 15. In both cases flies issued and died in the packets before August 14. The galls were seen also at Bagby, Los Gatos, and Santa Margarita. The new galls start to develop in April and are full grown in about a month. A similar gall occurs on *Q. agrifolia*, and when reared it will probably prove to be caused by this species.

CALLIRHYTIS GEMMARIA (Ashmead).

This species, described from Florida, has been reported in the literature from New Jersey and Ontario. The writer has seen the galls in Florida at Jacksonville, Gainesville, Marianna, River Junction, Carrabelle, Madison, St. Petersburg, Clearwater, Miami, Daytona, and Green Cove Springs; in Maryland on Plummer Island; in District of Columbia; in Virginia at Falls Church and Bluemont;

on Blue Hill, Massachusetts; at Miller, Indiana; in Illinois at Evanston, Fort Sheridan, and Palos Park; at Ironton, Missouri; and at Palestine, Boerne, Austin, and Kerrville, Texas. They occur on *Quercus rubra*, *coccinea*, *falcata*, *ilicifolia*, *myrtifolia*, *pumila*, *catesbaei*, and *texana*, besides the oak from which it was described, *brevifolia*.

The young galls may be found forming from late May to early June, secreting honeydew from a gland at apex and at this stage containing a thick translucent nutritive layer inside, with a scarcely discernable larval cavity in center. On June 16, 1917, a cluster of developing galls was found at Fort Sheridan on *rubra* and watched at intervals during the summer. When visited a month later many of the galls were found to be plump and green, with a nipple at apex and many cells inside and they continued to enlarge and finally become woody and covered on outside with normal brown bark and remained on the tree all winter. They became the characteristic galls known in literature as *Andricus davisi* Beutenmueller, and from them only guest flies are reared. The types of *davisi* seen by the writer in six different collections are all guest flies of the genus *Synergus*. When attached by inquillines the galls, instead of dropping to the ground, keep on growing and remain on tree.

In the Bulletin of the American Museum of Natural History (vol. 42, 1920, p. 295), Doctor Kinsey, working with museum specimens only without field observations on the growing galls, recognizes that the characteristic galls of *davisi* yield only a *Synergus*, but he is in error in thinking that they are derived from *Callirhytis punctata* (Bassett). In favorable specimens one can often find on the summit of the *davisi* galls a trace of the nipple and ribbed surface of the normal *gemmaria* gall. In a footnote he admits the possibility of his error, but does not say from what they are derived.

True parasites by killing the maker may stunt the growth of a gall and cause a characteristic appearance, and guest flies may also modify it. Cecidologists when describing galls should be sure they are describing a normal structure, and one can not always be sure of this from single specimens. They may be sure it is normal if they rear the maker, or, failing in this, find the gall in numbers and especially season after season.

CALLIRHYTIS MEDULLAE (Ashmead).

Cynips medullae ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, Proc., p. 8.

The two type females in the United States National Museum have the head not distinctly broader than thorax and simple claws and they belong in *Callirhytis*. As the fore wings have very short pubescence, the margin without cilia, and the venation pale, the species is related to those species of the genus which are bred from flower galls and from stone galls in acorns.

CALLIRHYTIS MODESTA (Osten Sacken).

Cynips modesta OSTEN SACKEN, Proc. Ent. Soc. Phila., vol. 1, 1861, pp. 65–6.
Cynips papula BASSETT, Canad. Ent., vol. 13, 1881, p. 107.

C. modesta was described from three females from an irregular hard protuberance on both sides of leaf of red oak, the flies emerging in late June at Washington, District of Columbia. In the Museum of Comparative Zoology the type flies are gone from the pins, and the type gall looks like a fragment of the gall of *papula* Bassett, whose types the writer has seen at Philadelphia.

C. papula was described from a few females from a similar gall on red and black oak, the flies beginning to emerge July 12 in Connecticut. The only material of the adults of *papula* available for comparative study has been a fly reared by the writer from the characteristic gall on the leaves of red oak at Medina, New York (the gall contained pupae on July 2), and flies determined by Gillette from Iowa. The writer has seen the old galls at Rosslyn, Virginia. and at Hugo, Oklahoma, and taken the fresh galls many times in the Chicago area, where they were very common in 1917 and contained pupae on July 16. Thus the structure of the gall, the host oak, and the known facts of the biology correspond closely, for one would expect the flies to emerge two weeks earlier at Washington, and it seems propable that *modesta* and *papula* are but two names for one species.

If the material studied has been correctly determined, as seems probable, the species has nonciliate fore wings, claws simple, second tergite not tongue-shaped, and a very long ovipositor over 12 times the width of head. It is closely related to the flies reared from flower and acorn stone galls in the genus *Callirhytis*.

CALLIRHYTIS MYRTIFOLIAE (Beutenmueller).

Andricus myrtifoliae BEUTENMUELLER, Canad. Ent., vol. 49, 1917, p. 346.

This species has tarsal claws simple and belongs in the genus *Callirhytis* along with most species reared from flower galls. Using a cotype female for balsam mount, the length of mesonotum ratio is 1.22; antenna, 2.27; ovispositor, 1.9; wing, 3.25. It is one of a group of species with the ovispositor very short as compared with those species of flower gall flies known to ovisposit in acorns.

CALLIRHYTIS OBTUSILOBAE (Bassett).

Andricus obtusilobae BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 316.

Described from two females from an unknown gall. The type fly in Philadelphia is a *Callirhytis*, with nonciliate fore wings and pale venation, and is related to those species bred from flower galls.

CALLIRHYTIS PARVA, new species.

Female.—Reddish-brown. antennae and tarsi yellowish. Head, sides of pronotum, and mesoscutum coarsely coriaceous in balsam, but looking almost punctate or rugose under binocular. Scutellum rugose, with well-separated smooth pits at base. Malar space half eye. Antennae, 12-segmented; 1 and 3 subequal, last equal to two preceding. Parapsidal grooves complete; median a mere notch. Wings hyaline; venation obliterated beyond second cross vein; surface short pubescent; margin not ciliate; no areolet. Hind tarsus shorter than tibia; tarsal claws simple. Abdomen equal to head and thorax, nearly as broad as long; pubescent patches at base inconspicuous—no woolly ring; all tergites visible along dorsal margin; ventral valves turned up into nearly vertical position, and conspicuous, ventral spine about four times as long as broad. Using width of head as a base, the length of mesonotum ratio is 1.08; antenna, 2.3; ovipositor, 5.0; wing, 3.2.

Range in size, 1.5–2.2 mm.; average, 2 mm.

Male.—Body nearly black; antennae yellow, 14-segmented, flagellum tapering toward tip; all its segments stout and barrel-shaped. Fore wing margin ciliate. Abdomen shorter than thorax.

Range in size, 1.4–1.7 mm.; average, 1.6 mm.

Described from 20 female and 6 male specimens.

Type.—Cat. No. 24727. U.S.N.M. Type female, allotype and 12 female paratypes.

Host.—*Quercus imbricaria.*

Gall.—On the staminate flowers dropping to the ground about the middle of May. Somewhat globular, greenish-white, covered with coarse sprawling pubescence, 3–4 mm. in diameter, single or in clusters. Fleshy at surface, but harder inside; usually two-celled.

Type locality.—Rosslyn, Virginia, near old fortifications on Leesburg pike above Chain Bridge. Collected May 16, 1920, and flies cut out of galls June 11. The United States National Museum has a similar gall from Cadet, Missouri, collected by J. G. Barlow, May 3, 1895.

CALLIRHYTIS POMIFORMIS (Bassett).

Cynips pomiformis BASSETT, Canad. Ent., vol. 13, 1881, p. 74.

Callirhytis maculipennis KIEFFER, Bull. Hist. Nat. Metz, ser. 2, vol. 11, 1904, p. 131.

C. maculipennis was described from material sent by C. F. Baker from Claremont, California, from *Q. agrifolia*, and the types were returned to Baker. The writer has seen the type galls and flies at Pomona College and galls at Stanford University from Baker. It seems to be a synonym of *pomiformis*, and the Pomona material is labeled in Baker's hand "Callirhytis maculipennis Kiefer = Andricus pomiformis Bassett," showing that before Baker left Pomona he recognized that they were the same.

CALLIRHYTIS QUERCUS-PHELLOS (Osten Sacken).

Cynips quercus-phellos OSTEN SACKEN, Proc. Ent. Soc. Phila., vol. 1, 1861, p. 70.

Cynips similis BASSETT, Proc. Ent. Soc. Phila., vol. 4, 1865, pp. 346, 350, 379.

C. quercus-phellos was described from four specimens, reared June 29, from Virginia side of Potomac near Washington, the types being deposited in the Museum of Comparative Zoology, from which the United States National Museum obtained a paratype by exchange.

The United States National Museum has a cotype fly and gall of Bassett's *similis*, a gift from the American Museum, which cannot be separated from the above, although the galls of *similis* are on *Q. ilicifolia* instead of on *Q. phellos*, hence *similis* becomes a synonym of the older name.

The writer has seen what seems to be the same gall on *Q. falcata, brevifolia, texana, laurifolia,* and *myrtifolia*, but has never reared adults.

CALLIRHYTIS TURNERII (Ashmead).

Cynips turnerii ASHMEAD, Trans. Amer. Ent. Soc., vol. 9, 1881, Proc. p. 16.

Andricus topiarius ASHMEAD, Trans. Amer. Ent. Soc., vol. 14, 1887, p. 136.

C. turnerii was described from three females bred from a woolly flower gall on water oak, *Q. nigra.* The types are in the United States National Museum, as well as other females and males determined by Ashmead, also from Jacksonville, Florida. Mayr correctly transferred it to *Callirhytis* in 1902, aad with its uniform light yellowish-brown color, pale venation, and nonciliate front wings in female, the species belongs in that section of the genus which includes most of the flower galls and the acorn stone galls.

A. topiarius was described from two females, one of which is in the National Museum, the other in Philadelphia. The writer is unable to separate the type from *turnerii.* It was, however, described from a bud gall on post oak, but there would seem to be some mistake here. The type galls are of the same general type as those of *stropus* Ashmead, *foliatus* Ashmead, *flavohirtus* Beutenmueller, all of which are on white oaks and give flies which go in the genus *Andricus.* The type of *topiarius* is closely related to those species of *Callirhytis* which are reared from galls on red oaks. It seems probable that Ashmead has associated the two flies reared with the wrong gall and that it will make for progress to call *topiarius* a synonym of *turnerii.*

AMPHIBOLIPS TRIZONATA Ashmead.

The gall of this species was said to be "in the blossoms of an oak," but no description was given and the host oak unknown. The type galls in the United States National Museum bear the same U.S.D.A. number as the flies, 2668, and are from Port Grant, Arizona. They are very characteristic, and the writer has taken them many times.

Host.—*Quercus emoryi* and *Quercus hypoleuca.*

Gall.—Globular, 25–40 mm. in diameter; green. turning to a tan later; smooth or with a finely coriaceous surface. Interior of a dense cellular structure lighter in color than surface, but darker toward the nonseparable larval cell in center. From the attachment a number of whitish strands run up through the cellular tissue to the larval cell. Attached singy to side of small twigs, not a flower gall.

Habitat.—The writer has collected these galls at Prescott, Oracle, Nogales, Patagonia, Huachuca Mountains in Ramsey Canyon, and in the Mule Pass Mountains near Bisbee, Arizona. At Hanover Junction, New Mexico, on July 16, 1918, *emoryi* trees were seen bearing hundreds of these galls and looking like apple trees full of fruit. Some were full grown and still green, while others showed all stages in the process of turning from green to tan, and these contained early and late pupal stages or adults and a few had already begun to emerge. Some of the last season's old and weather galls still hung on the trees. The museum has galls from Chiracahua Mountains also.

The gall of *Amphibolips palmeri* Bassett is of the same type but larger, being 65 mm. in diameter and from an unknown Mexican oak. The flies of *palmeri* and *trizonata* differ from all the other species of *Amphibolips* in having transversely banded wings. Mr. S. A. Rohwer has been kind enough to take a type of *trizonata* to Philadelphia and compare it with the type of *palmeri* for me. The two species may be separated as follows: In *palmeri* the apical and stigmatic clouds of wing are confluent on hind margin and first cubital cell is dusky, second tergite closely punctured, scutellum more coarsely sculptured than mesoscutum, antennae 13-segmented, the apical much shorter than 11 plus 12; in *trizonata* the apical and stigmatic clouds are separate and distinct, first cubital cell not clouded, second tergite only sparsely punctured, little difference in sculpture of mesoscutum and scutellum, antennae 12-jointed, apical longer than two preceding.

BASSETTIA CEROPTEROIDES (Bassett).

Callirhytis ceropteroides BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 324.

The types of this species have a massive head much broader than the thorax; no malar groove; segment 3 of antenna longer than 4 in ratio of 13:10; mesoscutum coarsely coriaceous; parapsidal grooves obliterated in front; pits of scutellum small; fore wing not ciliate on margin; only subcosta and the two cross-veins visible; woolly ring at base of second tergite; ventral spine at least five times as long as broad. The species belongs in *Bassettia.*

BASSETTIA CORRUGIS (Bassett).

Holcaspis (?) *corrugis* BASSETT, Trans. Amer. Ent. Soc., vol. 14, 1887, p. 131.

From an unknown gall. Taken ovipositing in spring in buds of *Quercus prinoides*. As the head is broader than thorax, massive, the antennae not moniliform, the third segment longer than the fourth, last not twice preceding, the second tergite with an interrupted ring of hairs at base, pits of scutellum narrow, oblique, malar space less than half eye, and ventral spine five times as long as broad, the species is here transferred to *Bassettia.*

SYNERGUS CITRIFORMIS (Ashmead).

Ceroptres citriformis ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, p. 300.

The types of this species belong to the genus *Synergus.*

SYNERGUS OBTUSILOBAE (Ashmead).

Ceroptres obtusilobae ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, p. 300.

The types of this species belong in genus *Synergus.*

SYNERGUS POMIFORMIS (Ashmead).

Ceroptres pomiformis ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, p. 300.

The one type fly of this species in the United States National Museum is a female, not a male, and is a *Synergus.* The Museum of Comparative Zoology has a male sent to A. P. Morse and labeled in Ashmead's hand "*Synergus pomiformis* Ashm. W. H. Ashmead, donor, 1895."

SYNERGUS SUCCINIPEDIS (Ashmead).

Ceroptres succinipedis ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, p. 300.

The types of this species belong in *Synergus.*

SYNERGUS VIRENTIS (Ashmead).

Ceroptres virentis ASHMEAD, Trans. Amer. Ent. Soc., vol. 12, 1885, p. 300.

The three types in the United States National Museum and one in the Academy of Natural Sciences, Philadelphia, are all *Synergus.*

ANTISTROPHUS LIGODESMIAE-PISUM (Walsh).

Beutenmueller has very justly recognized that *Asclepiadiphila stephanotidis* Ashmead is but another name for this species. By a curious error Ashmead described these galls as occurring on *Stephanotis*, an introduced greenhouse climber belonging to the milkweed family and not found wild in this country and certainly not escaped from greenhouse at Oregon, Missouri, over 30 years ago. The label on the type galls plainly says *Stephanomeria*, which is a composite close to *Lygodesmia* distinguished by its pink flowers and plumose pappus and perhaps not separable from it on September 17, when the galls were collected and from the material sent in. Both have filiform naked branches, milky juice, and alternate leaves. Only one species of *Stephanomeria* would be at all likely to occur in that locality, and the genus is entirely omitted in the seventh edition of Gray, which does include that area, so there is strong probability that the host was misdetermined and that the *stephanotidis* galls were on *Lygodesmia*. At any rate, if it does attack the closely related genus *Stephanomeria*, no one has found it on it since. As *stephanotidis* is the genotype of the genus *Asclepiadiphila* Ashmead, *Antistrophus* Walsh and *Asclepiadiphila* Ashmead are isogenotypic through synonymy.

Dalla Torre and Kieffer have erroneously recognized the species *stephanotidis* and made *Asclepiadiphila* a synonym of *Aylax* instead of *Antistrophus*.

INDEX.

This index includes the names of all species referred to in this paper. Valid generic names are in boldfaced type; valid specific names in roman; synonyms in italics.

Page.

Acraspis Mayr 10
alaria, new species, Acraspis 13, 14
Antistrophus Walsh 27
Asclepiadephila Ashmead 27
ashmeadi Dalla Torre and Kieffer, Anacharis 6
badia (Bassett), Callirhytis 17
bignelli (Dalla Torre), Callirhytis 18
brevipennata (Gillette), Diplolepis 7
calycicola Ashmead, Andricus 15
capsuala Ashmead, Cynips 15
ceropteroides (Bassett), Bassettia 25
cicatricula Bassett, Andricus 16
cinnamomeus Ashmead, Andricus 15
citriformis (Ashmead), Synergus 26
concolorans Kinsey, Andricus 16
congregata (Ashmead), Callirhytis 18
corallosa Weld, Callirhytis 17
corrugis (Bassett) (Holcaspis), Bassettia 26
cryptica, new species, Callirhytis 19
davisi Beutenmueller, Andricus 21
echini Ashmead, Acraspis 14
erinacei Beutenmueller, Acraspis 14
fasciatus (Bassett), Dryocosmus 7
fuscipennis Kieffer, Ibalia 2
flavohirtus Beutenmueller, Andricus 24
flora, new species, Callirhytis 20
floridana Ashmead, Cothonaspis (Adleris) 6
foliatus Ashmead, Andricus 24
formosus (Bassett), Andricus 15
fulvicollis Fitch, Philonix 11
furnessae (Weld), Andricus 16
gemmaria (Ashmead), Callirhytis 20
gigas, new species, Philonix 11, 12
gillettei Bassett, Philonix 11
hirta Bassett, Acraspis 13
hirta Provancher, Lonchidia 6
hubbardi Ashmead, Zopheroteres 9
impositus Beutenmueller, Andricus 9
lamyi Cockerell, Anacharis 6
lanaeglobuli (Ashmead), Philonix 11
ligodesmiae-pisum (Walsh), Antistrophus 26
macrocarpa Bassett, Acraspis 13
maculipennis Kieffer, Callirhytis 23
maculipennis Haldeman, Ibalia 2

Page.

medullae (Ashmead), Callirhytis 21
mexicana Ashmead, Anacharis 6
modesta (Osten Sacken), Callirhytis 22
montana Beutenmueller, Amphibolips 18
myrtifoliae (Beutenmueller), Callirhytis 22
nigra (Gillette), Philonix 11
nigricollis Fitch, Philonix 11
obtusilobae (Bassett), Callirhytis 22
obtusilobae (Ashmead), Synergus 26
palmeri Bassett, Amphibolips 25
papula Bassett, Cynips 22
Parateras Ashmead 9
parva, new species, Callirhytis 23
pellucidus Kinsey, Andricus 7
petiolicola (Bassett), Andricus 16
pezomachoides (Osten Sacken), Acraspis 14
Philonix Fitch 10
poculum, new species, Xystoteras 7
politus Bassett, Xystoteras 8
pomiformis (Bassett), Callirhytis 23
pomiformis (Ashmead), Synergus 26
prinoides (Beutenmueller), Acraspis 14
punctata Ashmead, Trisolenia 18
quercus-phellos (Osten Sacken), Callirhytis 21
quinqueseptum Ashmead, Andricus 16
similis Bassett, Cynips 24
splendens (Weld), Diplolepis 7
stephanotidis Ashmead, Asclepiadiphila 26
stropus Ashmead, Andricus 24
succinipedis (Ashmead), Synergus 26
tarsale Ashmead, Liopteron 5
topiarius Ashmead, Andricus 24
trizonata Ashmead, Amphibolips 24
tumifica (Osten Sacken), Callirhytis 17
turnerii Ashmead, Callirhytis 24
undulata Gillette, Philonix 13
vaccinii Ashmead, Zopheroteras 9
vagabunda (Ashmead), Psilodora 6
vernus (Bassett), Andricus 17
villosa Gillette, Acraspis 13
virentis (Ashmead), Synergus 26
Zopheroteras Ashmead 9

NOTES ON AMERICAN GALLFLIES OF THE FAMILY CYNIPIDAE PRODUCING GALLS ON ACORNS, WITH DESCRIPTIONS OF NEW SPECIES.

By Lewis H. Weld,

Of the Bureau of Entomology, United States Department of Agriculture.

Only 8 American acorn galls have hitherto been described. The present paper gives descriptions of 12 new species, together with a synopsis of the galls and keys for the determination of the adults. It was prepared under the general supervision of Mr. S. A. Rohwer, Specialist in Forest Entomology, to whom acknowledgment is due for access to the material and records in the Division of Forest Insects, Bureau of Entomology.

Types of the new species have been deposited in the United States National Museum and paratypes and balsam mounts are with the author. Where sufficient material is at hand paratypes are available for exchange with other institutions for species not in the National Collection.

The author has field notes on some 36 other acorn galls not here included because adults have not as yet been reared. If systematic search were made, especially in early spring and in the autumn, no doubt still other species would be found not only in the eastern region, where most collecting has been done, but especially in the remoter parts of the country and on the more local species of oak. Acorn galls do not often occur in large numbers and are overlooked by the casual observer, but one is often guided to the smaller ones by noticing ants and wasps attracted by the secretion of honeydew. They are difficult to rear, as many require at least two seasons and meanwhile must be kept in a normal environment. Some form of wire breeding cage which can be kept out of doors on the ground will answer this purpose. The alternating generation in one instance is known to be a flower gall, and much work might be done on the biology of this group. From the above it will be seen that having reared the adults from an acorn gall the chances are almost two to one that it can not

No. 2440—Proceedings U. S. National Museum, Vol. 61, Art. 19.

be determined by the use of the subjoined keys because it is liable to be a new species, and yet it has seemed best to make the present paper somewhat monographic in treatment, as in the previous paper on root galls, that it may serve as the basis for future work. No extended bibliography of the described species has been given. The text figures are by Miss E. T. Armstrong and the photographs are by the author, except figure 9 on plate 3, which is from negative 774, Eastern Station, Division of Forest Insects.

SYNOPSIS OF THE ACORN GALLS PRODUCED BY AMERICAN CYNIPIDAE.

1. Galls on or in the tissue of the acorn cup and not involving the acorn.
    A. Large, globular, thick-walled, hard, mottled brownish or reddish galls produced on the side of the acorn cup, easily detached, dropping to ground in the fall (pl. 1, figs. 1, 2). Always on red oaks.
        On *Q. rubra, nana, velutina, coccinea.* 15-25 mm. in diameter. Shrivel in drying and becomes very hard.
        Amphibolips prunus Walsh, p. 5.
        On *Q. marilandica.* 25–35 mm. in diameter. Do not wrinkle in drying______________________**Amphibolips gainesi** Bassett, p. 4.
        On *Q. laurifolia, phellos.* 7–11 mm. in diameter.
        Amphibolips fulginosa Ashmead, p. 4.
    B. Smaller galls more or less embedded in the tissue of the cup, often slipping out on to the ground in the fall when mature.
        On *Q. bicolor.* Ellipsoidal white cell 4 by 7 mm. almost hidden in a fimbriate recess in the side of cup (pl. 1, fig. 3).
        Andricus fimbriatus, new species, p. 29.
    C. Cell in tissue of acorn cup and not separable from it.
        On *Q. bicolor.* Cell in bottom of cup under acorn causing it to become lopsided____________Undescribed species (pl. 5, fig. 20).
2. Galls known as "pip" galls produced between the acorn and the cup.
    A. Pip galls alongside full-grown acorn (often reduced in size) (pl. 4, fig. 15).
        On *Q. rubra, velutina, coccinea.*
        Callirhytis operator (Osten Sacken) agamic generation, p. 23.
    B. Galls alongside the immature acorns of red oaks (pl. 3, figs. 7, 8; pl. 4, figs. 14, 16, 17; pl. 5, fig. 18).
        On *Q. coccinea.* On the one year old acorns in early spring. Secrete honeydew_______**Callirhytis balanosa**, new species, p. 19.
        On *Q. velutina.* In fall alongside immature acorns.
        Callirhytis balanoides, new species, p. 27.
        On *Q. marilandica.* In fall. Longer than broad and deeply embedded alongside immature acorns, the cup twice normal size. Secrete honeydew.
        Callirhytis balanaspis, new species, p. 22.
        On *Q. marilandica.* In fall. About as broad as long, mostly protruding from young acorn cup which is not enlarged. Secrete honeydew_______**Callirhytis balanopsis**, new species, p. 26.
        On *Q. agrifolia, wislizenii.* Secrete honeydew.
        Callirhytis carmelensis, new species, p. 20.

3. **Galls inside the acorn.**
   A. Cells in a cluster, confluent or producing a stony mass more or less filling the interior and may be lifted out intact (pl. 2, figs. 4, 5, 6; pl. 3, fig. 9).
      On *Q. marilandica*__________**Callirhytis fruticola** Ashmead, p. 17.
      On *Q. rubra, coccinea, texana.*
      Callirhytis fructuosa, new species, p. 14.
      On *Q. brevifolia*__________**Callirhytis petrosa,** new species, p. 15.
      On *Q. agrifolia, wislizenii, californica.*
      Callirhytis milleri, new species, p. 11.
      On *Q. bicolor*____________**Callirhytis lapillula,** new species, p. 18.
      On *Q. hypoleuca*__________**Callirhytis petrina,** new species, p. 13.
   B. Cells single, not confluent, not separable from the wall of the acorn (pl. 3, fig. 10).
      On *Q. agrifolia, wislizenii, californica.*
      Biorhiza eldoradensis (Beutenmueller), p. 5.

The flies reared from these American acorn galls belong to but four genera of Cynipidae. For the purposes of the present paper they may be separated as follows:

KEY TO THE AMERICAN GENERA OF CYNIPIDAE PRODUCING GALLS ON ACORNS.

1. Large black species. Thorax robust, wider than head, coarsely sculptured. Claws with tooth. Front wing smoky or clouded, margin ciliate.
   Amphibolips Reinhard, p. 3.
   Not large black coarsely sculptured species. Thorax not distinctly wider than head. Front wing not clouded_____ ___________________________2.
2. Mesoscutum shining, smooth or very feebly coriaceous, claws simple.
   Biorhiza Westwood, p 5
   Mesoscutum dull if coriaceous but usually sculptured______ ___________3.
3. Tarsal claws simple. Front wing margin not ciliate.
   Callirhytis Foerster, p. 7.
   Tarsal claws with tooth. Wing margin ciliate________**Andricus** Hartig, p. 20.

Genus AMPHIBOLIPS Reinhard.

Of the eight described American species of Cynipidae producing galls on acorns three belong to the genus *Amphibolips.* Their galls are all of the same general type and are popularly known as "plum" galls. They are relatively large, heavy, smooth, globular galls attached by a single point to the side of the acorn cup and dropping to the ground in late summer and autumn. They are borne on acorns of the current season's crop and may or may not stunt them. When fresh they are reddish brown, mottled, fleshy, with a larval cavity in the center, the wall thick, dense, and often with a reddish juice. After they drop they lose weight and may or may not shrivel, wrinkle, and change shape somewhat; the kinds which wrinkle become very hard. The flies of these three acorn-gall-producing species belong in that section of the genus with *clouded* wings and are distinguished from all the other species of *Amphibolips* by having the base of the second tergite aciculate, while in all the others it is smooth. They are robust species, with the hind margin of second tergite and exposed parts of the rest *confluently* punctate.

KEY TO DESCRIBED ACORN-GALL-PRODUCING SPECIES OF AMPHIBOLIPS.

1. Wing uniformly dark smoky brown, almost black, with clear spot above costal hinge. Scutellum not emarginate and without distinct median groove on disk behind pits. Abdomen less than .8 as broad as long. Size 4.5 mm. Gall on *Q. laurifolia* Michaux and *Q. phellos* Linnaeus. 7–11 mm. in diameter________________________________**fuliginosa** Ashmead.

   Wing not uniformly smoky, but clouded in radial and apical cells. Scutellum emarginate with median groove on disk. Abdomen .9 as broad as long. Size about 6 mm____2

2. Parapsidal grooves percurrent but narrow, the median transversely rugose. Producing galls 25–35 mm. in diameter, which do not wrinkle or become exceedingly hard in drying. On *Q. marilandica* Muenchhausen. **gainesi** Bassett.

   Parapsidal grooves distinct in the sculpture only posteriorly, but their position indicated the rest of way by broad shallow depressions of surface. Median indistinct. Galls 15–25 mm. in diameter, becoming very hard and wrinkled in drying. On *Q. rubra* Linnaeus, *Q. velutina* Lamarck, and probably other red oaks______________________________**prunus** (Walsh).

Further collecting and rearing will no doubt discover additional species in this group of *Amphibolips*. No galls of this type are yet known from the Rockies and Great Basin or from the Pacific slope.

An undescribed gall, probably made by a species of this genus, is figured on plate 1, figure 1.

AMPHIBOLIPS FULIGINOSA Ashmead.

The galls of this species were described as dropping from trees of *Q. laurifolia* in August. The type flies were found dead in a box of galls put away four years earlier, so date of emergence was not known. The type locality is Jacksonville, Florida. The writer has collected galls on *Q. phellos* as well as on *Q. laurifolia* and at the following places: Jacksonville, Live Oak, Lake City, River Junction, Tallahassee, Carrabelle, Gainesville, Ocala, Clearwater, and Daytona, in Florida; Savannah, Georgia; Poplar Bluff, Missouri; and Rosslyn, Virginia. A pupa was found inside a gall on October 22 and an adult December 1. An adult emerged in breeding cage May 1. Transformation takes place in fall and the flies remain in the galls during the winter to emerge the next spring.

AMPHIBOLIPS GAINESI Bassett.

The type and only published locality for this species is Austin, Texas. The writer has collected the galls at Mineola, Palestine, Victoria, Cuero, and College Station, in Texas; Marianna, Florida; and at Texarkana and Hot Springs, Arkansas. At the latter place the galls were very abundant in October, 1917, many trees having a dozen or two underneath. At that date some of the galls contained pupae. Adults and full-grown larvae were found inside the next January and one emerged May 25, 1918. Transformation thus takes place in the fall and emergence the next spring. The emergence begins the first spring after the galls drop and is distributed over at least two seasons.

AMPHIBOLIPS PRUNUS (Walsh).

Plate 1, fig. 2.

These galls have been seen by the writer on *Q. rubra* at Kilbourn, Wisconsin; Porter, Indiana; and Ironton, Missouri. Like the others, transformation takes place in the fall and emergence in the spring, distributed over more than one season. Similar galls occur on various red oaks, and only by rearing the adults can it be determined whether they are all formed by this species or whether several species are involved. Illinois is the type locality, but until material reared from various oaks is at hand the host source of the type fly is in some doubt.

Genus BIORHIZA Westwood.

BIORHIZA ELDORADENSIS (Beutenmueller).

Plate 3, fig. 10.

Andricus eldoradensis BEUTENMUELLER, Bull. Brooklyn Ent. Soc., vol. 8, 1913, p. 105, fig. 12.—FELT, Key to Amer. Ins. Galls, N. Y. St. Mus., Bull. 200, 1918, p. 118.

This Californian species was described from males only and the type and a paratype male are in the United States National Museum. They are from Los Angeles and bear the Koebele number 109 in red ink. Recently a series of 31 additional specimens (11 males and 20 females) was discovered in the museum, all with the same Koebele number 109 and from Sonoma County. The author also has 6 males and 5 females reared in September from galls in *wislizeni* acorns, which he collected at Santa Margarita on August 13, 1916. Both sets of males agree with the types of *eldoradensis*, and the female of the species is here described for the first time. As the mesoscutum is smooth and shining, the parapsides percurrent, second segment of hind tarsus shorter than fifth and the third antennal segment of the male is emarginate, the species is here transferred to the genus *Biorhiza*.

Female.—Pale buff to honey-yellow, propodeum often darker, abdomen reddish brown, almost black posteriorly. Head coriaceous; seen from above axial line .56 width of head with cheeks widened behind and longer than eyes, face from in front elliptical, widest opposite middle of eyes, interocular space .55 transfacial and area 1.2 times as broad as high, malar space half eye with groove and parallel stria to mouth, low median ridge on face above clypeus, antennocular space less than ocellocular, palpi 5- and 3-segmented, antennae 14-segmented, lengths of first four as 16:7:17:12, 5–13 gradually shorter, last about 1.5 times preceding, distal third not more slender. Mesoscutum wider than long, shining, feebly coriaceous, with scattered hairs, parapsidel grooves deep, smooth, precurrent, their separation behind at least one tenth width of head, anterior and lateral lines faint. Scutellum rugoso-punctate with two large smooth pits at base. Carinae on propodeum bowed out, inclosing a space wider than high with trace of a median ridge in some specimens. Hind tarsus shorter than tibia, second distinctly shorter than fifth, claws simple. Wings hyaline, second abscissa of radius angled and slightly clouded, not longer than apical part of subcosta. areolet reaching one-fifth and cubitus two-thirds way to basal, surface pubescent, margin ciliate. Abdomen compressed, longer than broad, second tergite occupying .7 and with a transverse row of hairs across middle. Ventral valves protruding obliquely. ventral spine at least 3 times as long as broad. Ovipositor when dissected out 1.2 times as long as antenna. Using width of head as base the length of mesonotum ratio is 1.1, antenna 2.0, ovipositor 2.2–2.4, wing 3.4.

Length of 25 pinned specimens 2.4–3.1 mm. Average 2.8 mm. The 19 males including the types measure 2.7–3.3 mm. Average 3.1 mm.

Later 44 other adults, determined as this species, were found in the Hopkins collection (Hopkins U. S. No. 12561). They were from Ashland, Oregon, reared from acorns of *californica* of the 1914, crop, collected by P. D. Sergent on September 5, 1914. Unfortunately no acorns were preserved, but the adults were said to occur "in gall pockets on the inner surface of the acorn shells" and 8 were obtained from three acorns. The flies emerged September 5–October 7, 1914. They are larger than those from the smaller acorns of the other two species of oak. The 29 females range from 2.8–3.7 mm. Average 3.3 mm. The males range from 3.0–4.2 mm. Average 3.8 mm.

Host.—Quercus agrifolia Neé, *Quercus wislizeni* A. de Candolle, and *Quescus californica* Cooper.

Gall.—The gall produced by this species is underscribed. Separate woody cells are produced in the acorns, which are somewhat distorted in shape and usually under normal size (fig. 1). They are always in the lower third of the acorn and the cell is adherent to the wall of the acorn and not separable from it, projecting slightly into the interior cavity, which has a velvety lining and may contain traces of the cotyledons. An acorn may contain from one to half a dozen of these cells at various points around its periphery and the flies make separate holes to the exterior through the acorn cup. Occurs in late summer and autumn in acorns of current season's crop.

At the time the species was first described it was associated with a stony mass of galls more or less filling the interior of the acorn, the work of a new species described in the present paper as *Callirhytis milleri* Weld, page 11. Although this stony gall and the *eldoradensis* flies bore the same Koebele number, Beutenmueller suggested that the two might have nothing to do with each other. *C. milleri* produces a confluent mass of cells in the interior which can be lifted out intact; *eldoradensis* produces separate cells in base of acorn not separable from the wall. The type galls of *eldoradensis* consist of one acorn of each kind. The writer has seen both species working in the same acorn, but the two types of work are easily recognized.

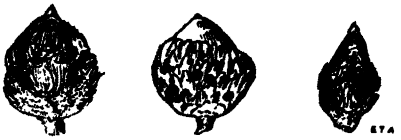


FIG. 1.—BIORHIZA ELDORADENSIS (BEUTENMUELLER). CELLS IN ACORNS OF WISLIZENI (TWO ON LEFT) AND AGRIFOLIA (ON RIGHT). × 1.

Habitat.—Acorns of *agrifolia* affected by this species have been seen by the writer at Newhall, Piru, Fillmore, in Ojai Valley, Montecito, Santa Barbara, Paraiso Springs, Los Gatos, Berkeley, and St. Helena, California. Those of *wislizeni* in San Gabriel River canyon above Azusa, at Santa Margarita, Los Gatos, and Bagby, California.

Genus CALLIRHYTIS Foerster.

All the species of this genus reared from acorn galls are, so far as now known, characterized by having remarkably hyaline winds due to the fact that the pubesence on the surface is either very short or almost wanting. The fore wing of the female also lacks the normal cilia on the margin, the fore wings of the males having the margin ciliate but the surface short pubescence like the female. The same is true of most species of this genus reared from root galls. All the oak flower galls (except two made by species in other genera), a number of twig swellings, a few midrib swellings, a hard leaf parenchyma gall and one bud gall also yield flies which go in this same section of the genus *Callirhytis*, so it seems best not to limit the discussion to the acorn gall species alone but to treat this section of the genus as a whole in order to bring together in one place all these related species and get some possible hints on life-history problems. Those flies which come from leaf parenchyma and midrib swellings have an unusually long ovipositor and they may oviposit in acorns and produce an acorn stone gall for the alternating generation. Certain species (sexual) from big wooly flower galls also have a long ovipositor, but not so long as those mentioned above. One of these is known to oviposit in the 1-year-old acorns of red oak and produce an acorn pip gall. On the other hand, several small species from small nonwooly flower galls have a very short ovipositor and may produce twig swellings, but these suggestions need to be confirmed by experimental studies on the life history of individual species.

This section of the genus *Callirhytis* with short pubescent, nonciliate wings may be divided roughtly as follows into two habitus groups:

Venation normal, veins beyond second cross-vein normally distinct; aerolet present (except in *fulva* Weld); pubescence on surface of wing distinct but short. Robust agamic forms with an average size of at least 3.0 mm. and usually over 3.5 mm ---------- SECTION A.

Venation usually very pale, the veins beyond second cross-vein colorless and barely visible; aerolet absent; pubescence represented by mere dots or absent. Body unicolored and usually light yellowish brown. Mesoscutum bare, coriaceous or rugose. Small species averaging (except in *fructuosa* Weld) less that 3.0 mm ---------- SECTION B.

SECTION A.

This group includes species from root galls and from pip galls besides acorns. As the root-gall species have been treated in a previous paper, they are not included in the following key. Those species bred from pip galls, besides acorns, have a distinct habitus in that they are robust light brown or yellowish species with the anterior and parallel lines sometimes infuscated, the mesoscutum uniformly covered with sparse short appressed pubescence which does not hide the sculpture, which is never coarse. If nonciliate winged species of *Callirhytis* are known to have been reared from root galls they should be run through the key on page 213 of the root-gall paper.[1] They have the mesoscutum so densely long pubescent as to hide the sculpture as in *Disholcaspis* or else bare or with but few setigerous punctures along the grooves.

KEY TO SPECIES OF SECTION A.

1. Parapsidal grooves distinctly percurrent ---------- 2
  Parapsidal grooves obsolete anteriorly—not distinctly reaching the front margin ---------- 5
2. Mesopleurae mostly bare and shining although aciculate. Large median dorsal black spot on second tergite. A pale species. California.
  carmelensis new species, p. 20.
  Mesopleurae mostly aciculate but dull and short pubescent, shining if at all only on upper hind margin. Mesoscutum coriaceous ---------- 3
3. Parapsidal grooves smooth and shining, almost uniform in width throughout. *Q. coccinea*. Gall in spring ---------- **balanosa**, new species, p. 19.
  Parapsidal grooves with transverse ridges, distinctly broadened behind ---------- 4
4. Antennae 14-segmented. Ocellocular space at least equal to and usually greater than postocellar ---------- **glandulus** (Beutenmueller), p. 23.

---

[1] Proc. U. S. Nat. Mus., vol. 59, no. 2368, 1921.

Antennae 13-segmented. Postocellar space at least equal to or greater than ocellocular..................... **operator** (Osten Sacken) (agamic), p. 23.

5. Mesoscutum entirely coriaceous—not more coarsely sculptured behind between parapsides than in front. Pits of scutellum sharply bounded behind—not opening out on to disk. Median groove at least longer than broad.....6

Mesoscutum more or less rugose, at least behind between parapsides.......7

6. Areolet indistinct. Wing ratio 3.6. Pubescent patches on sides of second tergite large, in side view occupying half the area. *Q. phellos*. Gall in spring.............................. **middletoni**, new series, p. 25.

Areolet well-defined. Wing ratio 4.2. Pubescent patches on second tergite not occupying half the area in side view. *Q. marilandica*. Gall in fall. **balanopsis**, new species, p. 26.

7. Mesoscutum finely rugose all over. Parapsidal grooves indistinct in the sculpture. No median. *Q. marilandica*. Gall in fall. **balanaspis**, new species, p. 22.

Mesoscutum slightly rugose behind between parapsides, the scutellum there being coarser than in front.....................8

8. "Areolet absent." Bred from a spring gall on second year acorns of *Q. ilicifolia*.................. **perditor** (Bassett), p. 28.

Areolet present.....................9

9. Antennal segment 3 longer than 1 plus 2. Median line reaching forward halfway. Distinctly rugose between parapsidal grooves and lateral lines. Scutellum with prominent hump on disk back of pits. *Q. velutina*. Gall in fall.................. **balanoides**, new species, p. 27.

Antennal segment 3 shorter than 1 plus 2. Median not reaching halfway. Coriaceous between parapsidal grooves and lateral lines. Disk of scutellum without hump anteriorly. Ovipositing April 8–11, *Q. ilicifolia*. **patiens** (Bassett), p. 28.

SECTION B.

This group includes all the known forms (agamic) bred from "stone" galls in acorns, all but two of the species described from oak flower galls, one from a hard leaf parenchyma gall, one from a bud gall, some from midrib swellings and several from slight twig swellings. It has not been possible to assemble all these species in one place for study, and the following key is at best but provisional.

KEY TO SPECIES OF SECTION B.

1. Mesoscutum mostly or entirely coriaceous, sometimes slightly rugose posteriorly.....................2

Mesoscutum mostly and distinctly rugose, if coriaceous only anteriorly...20

2. Mesoscutum entirely coriaceous.....................3

Mesoscutum slightly rugose behind between parapsides and sides of pronotum more or less rugose.....................16

3. Pronotum rugose on sides. Venation complete including areolet. Antennae of female 15, of male 16 segmented. Flower gall. California. **congregata** (Ashmead).

Pronotum coriaceous like mesoscutum. Venation obliterated in distal half of wing, rarely showing areolet. Antennae of female 12, 13, and 14 segmented.....................4

4. Abdomen with conspicuous interrupted ring of dense woolly pubescence at base. From twig swellings and bud gall.....................5

Abdomen with only usual lateral pubescent patches at base, not a woolly ring ---------- 9

5. Ventral spine abnormally long and slender, at least nine times as long as broad, longer than hind coxa ---------- 6

Ventral spine not over five times as long as broad, shorter than hind coxa -- 7

6. Tergites all visible on dorsal margin. Ventral spine longer than hind tibia. From club-shaped twig swelling. Atlantic coast plain. Various red oaks ---------- **quercus-phellos** (Osten Sacken).

Tergites 2 and 3 only visible dorsally. Ventral spine shorter than hind tibia but twice hind metatarsus. From bud gall. *Q. myrtifolia, falcata.* **cryptica** Weld.

7. Sides of pronotum rugose. Mesoscutum microscopically coriaceous and somewhat shining. *Q. ilicifolia* ---------- **tuberosa** Bassett.

Sides of pronotum coarsely and beautifully coriaceous and dull like the mesoscutum ---------- 8

8. Median groove absent. Head massive, semicircular when seen from above. *Q. brevifolia* ---------- **medullae** (Ashmead).

Median groove more than a mere notch on hind margin—at least longer than broad. Head from above transverse, its length one-third width. *Q. catesbaei* ---------- **crypta** (Ashmead).

9. Abdomen of female with all tergites visible dorsally and ventral valves prominently protruding. Abdomen equal to or longer than head and thorax. Ovipositor long, ratio at least 4.4 times width of head ---------- 10

Abdomen of female showing dorsally only tergites 2 and 3, the rest all telescoped so abdomen is somewhat truncate and distinctly shorter than head and thorax, ventral valves not prominent. Ovipositor short, ratio not over 2.6. Small species less than 1.9 mm. From flower galls ---------- 13

10. Mesopleurae entirely coriaceous. Abdomen equal to head and thorax. Antennae usually 12-segmented, last over twice preceding. Ovipositor ratio 4.5. From flower galls ---------- 11

Mesopleurae partly striate. Abdomen longer than head and thorax. Antennae usually 13-segmented, last two subequal. Ovipositor ratio at least 6 ---------- 12

11. Ventral valves protruding prominently backward at angle of 45° so abdomen is triangular. Female 1.8 mm. Male 1.7 mm. *Q. nigra.* **turnerii** (Ashmead).

Ventral valves turned up into nearly vertical position and nearly reaching dorsal line. Female 2.0 mm. Male 1.6 mm. *Q. imbricaria.* **parva** Weld.

12. Ventral valves turned up into vertical position but not protruding or reaching dorsal line. Ovipositor ratio over 12. Scutellum with narrow transverse furrow at base. Female 1.4–1.6 mm. Hard polythalamous leaf parenchyma gall. *Q. rubra* ---------- **modesta** (Osten Sacken).

Ventral valves prominently protruding and nearly reaching dorsal line. Ovipositor ratio about 6. Scutellum with distinct pits. Average size of female 2.7 mm. Male 2.0 mm. Woolly flower gall. *Q. coccinia, marilandica,* etc ---------- **operator** (Osten Sacken) (sexual).

Closely related species. Gall unknown. Connecticut-**obtusilobae** (Bassett).

13. Whole body brownish; submarginal and both cross-veins brownish. Antennae 13–14 segmented. *Q. rubra, coccinea* ---------- **pulchra** (Bassett).

Whole body yellowish, all veins transparent. Antennae 12–13 segmented - 14

14. Malar space 0.46 eye. Interocular area 1.54 times as broad as high. Q. *brevifolia* ---------- **blastophaga** (Ashmead).
Malar space 0.37 eye. Interocular area 1.38 times as broad as high ---------- 15
15. Wing ratio about 3.8. Ovipositor ratio 2.4. Q. *ilicifolia* ---------- **clarkei** Bassett.
Wing ratio about 3.3. Ovipositor ratio 1.9. Q. *myrtifolia*. **myrtifoliae** (Beutenmueller).
16. Areolet wanting. Ovipositor very long, ratio 11. From midrib swellings. New England ---------- 17
Areolet present. Ovipositor ratio less than 10 ---------- 18
17. All veins transparent. Q. *marilandica* ---------- **nigrae** (Osten Sacken).
Subcosta and cross-veins brownish. Q. *rubra* ---------- **tumifica** (Osten Sacken).
18. First and second cross-veins heavy, brown, clouded. Disk of scutellum not margined behind ---------- 19
First and second cross-veins not conspicuously heavy, brown, or clouded. From acorn gall. Arizona. Q. *hypoleuca* ---------- **petrina**, new species, p. 13.
19. Areolet reaching one-sixth to one-fifth way to basal. Ovipositor ratio 9.3 Midrib swelling. Q. *wislizeni*. California ---------- **flora** Weld.
Areolet reaching one-fourth way to basal. Ovipositor ratio less than 4. Stone gall in acorn. California ---------- **milleri**, new species, p. 11.
20. Mesoscutum rugose between parapsides but not transversely so, sometimes becoming coriaceous in front. From stone galls in acorns ---------- 21
Mesoscutum more or less transversely rugose between parapsides ---------- 23
21. Antennal ratio less than 1.6. Carinae on propodeum not converging above. Mesoscutum rugose all over, more coarsely so posteriorly. Thorax and abdomen nearly black ---------- **fructuosa** Weld, p. 14.
Antennal ratio over 1.7. Carinae on propodeum converging above with traces of one to three longitudinal ridges between. Head and thorax reddish ---------- 22
22. Ovipositor ratio 3.25. Antennae 13—segmented in only specimens known. Q. *brevifolia*. Texas ---------- **petrosa**, new species, p. 15.
Ovipositor ratio unknown—perhaps 4.8. Antennae 14—segmented but perhaps 13 also. Host unknown. Connecticut ---------- **corrugis** (Bassett), p. 16.
23. Scutellum disk broader than long, margined behind, with coriaceous spot in front just behind pits. The transverse sculpture of mesoscutum becoming coriaceous anteriorly. Light brown species. Q. *marilandica*. **fructicola** Ashmead, p. 17.
Scutellum disk as long as broad, not margined, all rugose. Transverse ridges on mesoscutum sharp and parallel clear to front margin. Dark brown species. Q. *bicolor* ---------- **lapillula**, new species, p. 18.

CALLIRHYTIS MILLERI, new species.

Plate 2, fig. 4, and plate 3, fig. 9.

Female.—Reddish-brown, the tips of mandibles, distal half of antennae, scutellum, metathorax, propodeum and abdomen nearly black. Head slightly broader than thorax, coriaceous becoming slightly rugose on the face; seen from above axial line about half width of head and cheeks gibbous; facial line .75 transfacial, clypeus emarginate, interocular space .56 transfacial and area 1.45 times as broad as high, malar space .53 eye with 3–4 parallel ridges to mouth.

antennocular and ocellocular spaces equal, palpi 5- and 3-segmented, antennae 13-segmented with lengths of first five as 23:9:18:14:14, 6–12 gradually shorter, last 2.5 times preceding and sometimes incompletely divided or 14-segmented with last not twice preceding which is as broad as long. Sides of pronotum rugose. Mesoscutum broader than long, with slightly transverse ridges on a coriaceous but not shining background, the rugose sculpture more pronounced posteriorly, parapsidal grooves percurruent, broader behind where their separation is slightly less than that of anterior lines, fine lines over base of wings, slightly infuscated posteriorly. Scutellum more coarsely rugose, transverse groove at base with about 15 longitudinal ridges, the median scarcely more prominent and not making two foveae. Carinae on propodeum almost straight and parallel, the area between rugose with one or two longitudinal ridges. Mesopleura coriaceous, lower third shining. Wing hyaline with slight cloud in costal cell near hinge, first and second cross-veins heaviest and slightly clouded, first abscissa of radius rounded, second pale and not reaching margin, areolet reaching one-fourth and cubitus all way to basal, surface very short pubescent, margin not ciliate. Hind tarsus shorter than tibia, second and fifth equal, claws simple. Abdomen longer than broad, second tergite occupying .53 length, its hind margin and exposed parts of others microscopically coriaceous, hypopygium in balsam almost as long as width of head, ventral spine not projecting, ventral valves oblique, ovipositor when dissected out over twice as long as antennae, ovarian eggs well developed. Using width of head as a base, the length of mesonotum ratio is 1.2, antenna 1.6–1.9, ovipositor 3.0–3.8, wing 3.1–3.4.

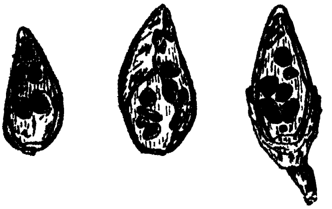


Fig. 2.—Callirhytis milleri, new species. Cells in acorns of agrifolia. × 1.

Range in length of 38 pinned specimens 2.4–3.7 mm. Average 2.83 mm.

Type.—Cat. No. 21793, U.S.N.M. Type and 24 paratypes.

Paratypes also in Carnegie Museum, Pittsburgh, Pennsylvania.

Host.—*Quercus agrifolia* Neé, *Quercus californica* Cooper, *Quercus wislinzeni* A. de Candolle.

Gall.—A compact stony-hard mass containing four to a score or more confluent cells inside of and in *agrifolia* and *wislizeni* acorns more or less filling the interior of the acorn, which is frequently reduced in size (fig. 2). The woody mass thus occupies the center of the acorn instead of the cotyledons, extends its whole length, and when the acorn is cut open can be lifted out intact. In *californica* the acorns are of normal size and the cotyledons are present but distorted. Occurs in late summer or fall in acorns of current season's crop. See notes on *Biorhiza eldoradensis* (Beutenmueller), p. 7.

Habitat.—The type locality is Pacific Grove, California, where affected *agrifolia* acorns were collected November 15, 1913, by Mr. J. W. Miller, who reared 20 adults March 8–27, 1915, sent in with galls under Hopkins U. S. No. 10867*b* and for whom the species is named. The writer collected some at Palo Alto, August 10, 1915, and cut out a pupa September 17, 1917, and a living fly December 19, 1917, indicating that transformation takes place the fall before emergence. The writer has also taken the galls at Alpine, Pasadena, Santa Barbara, Paso Robles, Los Gatos, and St. Helena, California. The writer found similar galls in old *wislizeni* acorns at Camp Baldy, June 15, 1918, and living adults were cut out December 2, 1919, and an equal number of larvae found indicating that the emergence is distributed over at least two seasons. These flies agree with those from *agrifolia* acorns except that they average 2.6 mm. instead of 2.8 mm. in length. Similar ones were seen in the San Gabriel River canyon in the San Gabriel Mountains and at Bagby in the Sierras. Mr. F. H. Herbert sent in similar galls in acorns in *californica* from Onion Valley, in Eldorado County, under Hopkins U. S. No. 13643*c* and from Los Gatos under Hopkins U. S. No. 13673*c*. From the latter five flies emerged March 31 to April 15. They are similar to the others except in being larger, averaging 3.1 mm., and they are included in the type series.

CALLIRHYTIS PETRINA, new species.

Female.—Head, prothorax and mesoscutum reddish-brown, rest of thorax infuscated, abdomen black. Head distinctly broader than thorax, coriaceous, seen from above axial line half width of head, cheeks gibbous; facial line .76 transfacial, clypeus emarginate, interocular space .55 transfacial and area 1.23 times as broad as high, malar space .46 eye with parallel ridges in groove, ocellocular and antennocular spaces equal, palpi 5- and 3-segmented, antennae infuscated, first five segments in balsam as 54 : 25 : 52 : 40 : 37, 6–12 gradually shorter, thirteenth 2.3 times preceding. Sides of pronotum rugose. Mesoscutum not shining, only slightly broader than long, coriaceous, slightly rugose between parapsides posteriorly, parapsidal grooves obsolete anteriorly, anterior and lateral lines present. Scutellum coarsely rugose, transverse furrow at base not bounded at sides and with longitudinal ridges in it but no pits. Carinae on propodeum slightly bent out, almost parallel, area between slightly rugose. Hind tarsus shorter than tibia, second equal to fifth, claws simple. Wing hyaline, all veins pale, first abscissa of radius arched, second reaching margin, areolet reaching one-fifth way to basal, surface short pubescent, margin not ciliate. Abdomen not compressed, as broad as long, second tergite occupying three-fourths length, its hind margin and exposed parts of rest microscropically coriaceous, hypopygium in balsam about .7 width of head, ventral spine not longer than broad, ovipositor when dissected out not 1.5 times length of antenna. Using width of head as a base, the length of mesonotum ratio is 1.2, antenna 1.9, ovipositor 2.7, wing 3.5.

Length of two pinned specimens each 2.4 mm.

Type.—Cat. No. 6418, U.S.N.M. One cotype.

Host.—*Quercus hypoleuca* Engelmann.

Gall.—A few loosely connected, thin-walled woody cells inside the acorn. Found in summer in acorns of current season's crop.

Habitat.—The type material was collected in Sabino Basin in the Santa Catalina Mountains, Arizona, June 28, 1918. Three living adults were cut out December 2, 1919. Normal emergence is probably in the spring. Acorns similarly affected were seen in the Huachuca Mountains also.

CALLIRHYTIS FRUCTUOSA, new species.

Plate 2, fig. 5.

Female.—Black, head and parts of legs often more or less reddish-brown. Head finely rugose, as broad as thorax, seen from in front elliptical with facial line .73 transfacial and interocular area 1.25–1.4 times as broad as high; broadened behind eyes, thickness .42 width, ocellocular space equal to antennocular, malar space .4 eye and with several parallel ridges, mandibles, 2-toothed, palpi 5- and 3-segmented, antennae 12-segmented, first and third subequal, fourth three-fourths third, 5–11 gradually shorter, last two and three-eighths preceding. Pronotum rugose. Mesoscutum longer than broad, finely rugose, parapsidal grooves obliterated in front, their separation behind .24 width of head, anterior and lateral lines distinctly raised into ridges, no median. Scutellum more coarsely rugose, narrow transverse groove at base foveolate and not limited laterally, often emarginate behind. Propodeum with many ridges radiating from rugose peduncle, the usual carinae strongly divergent above. Mesopleura finely pebbled with a few parallel ridges across middle. Hind tarsus shorter than tibia, second and fifth subequal, claws simple. Wings hyaline, subcosta and first and second cross-veins yellowish, rest pale, short pubescent, margin ciliate only on hind wing. Abdomen longer than broad, slightly compressed, smooth, shining, second segment occupying .4 length, bare at base, its hind margin and exposed parts of rest finely punctured, ventral spine not longer than broad, ovipositor when dissected out about two-thirds length of antenna, ovarian eggs well developed. Using width of head as a base the length of mesonotum ratio is 1.2–1.3, antenna 1.3–1.5, ovipositor 0.96–1.13, wing 3.14–3.30.

Range in length of 200 measured specimens 2.45–4.2 mm. Average 3.45 mm.

Type.—Cat. No. 6420, U.S.N.M. Type and 39 paratypes.

Paratypes also in Carnegie Museum, Pittsburgh, Pennsylvania, and with United States Biological Survey.

Host.—*Quercus rubra* Linnaeus, *Quercus coccinea* Muenchhausen, and *Quercus texana* Buckley.

Gall.—A stony mass of cells inside the acorn more or less filling the interior and encroaching upon or obliterating the cotyledons. They can not be separated at present from the galls of *Callirhytis fruticola* Ashmead, whose host source is in doubt.

Habitat.—The type locality is Ironton, Missouri. The *Q. rubra* material was collected at Ironton on October 5, 1917, from a tree on a steep ravine slope in the woods. The affected acorns are about full size, but nearly black, and one can soon learn to distinguish them. They drop before the normal acorns and they then contain larvae. Adults emerged in breeding cage April 25, May 5, 10, 12, and 18, 1919, and more in 1920. These galls were seen in *Q. rubra* acorns at Richmond and Wharton, Texas, and found once at Evanston, Illinois, and at Bluemont, Virginia.

About Chicago similar galls giving similar but smaller flies are much more common in acorns of *Q. coccinea.* A large number of the affected acorns of the 1916 crop were gathered at Evanston, Illinois, on April 22, 1917, and two adults were cut out in September of that year and more September 1, 1918. A lot issued May 5–18, 1919, and more in 1920. As the *coccinea* acorns are smaller than those of *Q. rubra* the cells are smaller and so are the flies. One hundred flies from each source were measured with results as follows: From *rubra*, range 2.75–4.20, average 3.89 mm.; from *coccinea*, range 2.45–3.60, average 3.01 mm. Galls in *coccinea* acorns have been seen at Winnetka, Illinois; Webster Groves, Missouri; and at Ithaca, New York, where on August 17 the red squirrels were opening the affected acorns for the well-developed larvae and dropping the fragments on the ground.

Similar cells inside acorns of *Q. texana* were found October 25, 1917, at Boerne, Texas. Living flies were cut out November 7, 1920. Twelve of these average 3.34 mm.

CALLIRHYTIS PETROSA, new species.

Female.—Reddish-brown, tips of antennae and posterior two-thirds of abdomen infuscated. Head broader than thorax, coriaceous, seen from above axial line half width of head, facial .76 transfacial, clypeus slightly emarginate, interocular space .53 transfacial and area 1.25 times as broad as high, malar space .46 eye with groove, ocellocular space slightly greater than antennocular, palpi 5- and 3-segmented, antennae 13-segmented, lengths of first five segments in balsam as 17:7:14:12:11, 6–12 gradually shorter, last twice preceding. Sides of pronotum rugose. Mesoscutum broader than long, rugose all over, parapsidal grooves complete, converging abruptly as they approach scutellum where their separation is less than that between the faint anterior lines. Scutellum also rugose, the transverse groove at base with about 8 longitudinal ridges of which the median is slightly heaviest. Carinae on propodeum slightly bowed out, the area between with about seven minor vertical ridges. Hind tarsus slightly shorter than tibia, second and fifth equal, claws simple. Wing hyaline, veins very pale, only short traces of those beyond second cross-vein visible, no areolet, pubescence on surface visible only under high magnification, margin not ciliate. Abdomen slightly compressed, broader than long, obliquely placed, second tergite occupying .69 of the dorsal length, smooth, exposed parts of others microscopically coriaceous, ventral spine not longer than broad, ovipositor when dissected out about 1.75 times length of antenna. Using width of head as a base the length of mesonotum ratio is 1.17, antenna 1.8, ovipositor 3.25, wing 3.0.

Length of three pinned specimens 3.0–3.1 mm.

Type.—Cat. No. 6419, U.S.N.M. Three cotypes.

Host.—*Quercus brevifolia* Sargent.

Gall.—A mass of confluent woody cells inside the acorn in place of the normal cotyledons. Found in fall affecting acorns of current season's crop and causing them to be more or less stunted in size.

Habitat.—The type locality is Palestine, Texas, where affected acorns were collected October 16, 1917. Five living flies were cut out of galls on December 1, 1919, and as full-grown larvae were also found the emergence is distributed over at least two seasons. The normal emergence is probably in the spring. Similar galls were seen at Ocala and at St. Petersburg, Florida, in autumn of 1919.

CALLIRHYTIS CORRUGIS (Bassett).

Cynips corrugis BASSETT, Canad. Ent., vol. 13, 1881, p. 109.

This species was described from one specimen taken on May 11 at Waterbury, Connecticut, from the claws of a spider on flowers of *Q. prinoides*. It is preserved in the Academy of Natural Sciences, Philadelphia, where the writer has examined it. It is a *Callirhytis* with nonciliate fore wings, pale venation, simple claws, and is clearly related to those species known to have been reared from stone galls in acorns. The mesoscutum is rugose all over, not tranversely so, coarser behind, the transverse groove at base of scutellum is rugose and of uniform width so that disk is rounded in front, the carinae of propodeum converge slightly above and the first and second cross-veins are not clouded.

Determined as this species without direct comparison with the type, the writer has specimens taken at Great Falls, Virginia, and others taken ovipositing in buds of *Q. coccinea* at Washington on March 27, 1921. Some of these specimens have 13 and others 14 segments in antenna, while *corrugis* was described as 14-segmented, but the number may vary. If these are correctly determined the only character so far found to separate them from *petrosa* Weld is the length of the ovipositor, ratio 3.25 in *petrosa* and 4.8 in those determined as *corrugis*.

The gall of *corrugis* is still unknown. The sculpture of the fly suggests that it came from a stone gall in an acorn, probably on *coccinea* or *ilicifolia*. The alternating generation is also unknown.

CALLIRHYTIS FRUTICOLA Ashmead.

The first of the "stony" acorn galls recorded in the American literature were sent by Thomas Meehan, of Philadelphia, to Dr. C. V. Riley, whose notes (105*x*) say that when opened December 1, 1871, he found one "fully perfected" fly. In 1875 Hubbard found similar galls inside of acorns at Detroit. Later Koebele sent what was then supposed to be the same thing from Alameda, California (*milleri* of this paper). In 1892 Miss Murtfeldt found galls in Missouri and intimates that both Hubbard and Riley have reared it.. Ashmead described the species from six specimens and says the acorns in Riley's collection were those of "*Quercus tinctoria*" Michaux and that the flies were reared April 3, 1873.

The type material in the national collection consists of four flies on one pin with the label "105*x*, acorn stony gall" with no locality or date. The acorns in the collection are from Detroit. The source and host of the species is thus in doubt. Moreover, one of the four type flies is different from the other three, being larger and with different sculpture. Although the description applies equally well to both, the writer prefers to assume that the three smaller flies are *fruticola* Ashmead and that the larger one is new, but as its host is not now known it is not here described. Flies agreeing with the above types of *fruticola* have been reared by the author from affected acorns of *Quercus marilandica* Muenchhausen collected at Ironton, Missouri, October 5, 1917, giving one definite host record for this species. The flies were cut out of the galls December 1, 1919, but the normal emergence would probably have been in the spring of 1920. Two of the *fruticola* types measure 2.5 and 2.7 mm. The author's 29 flies from Ironton range from 1.8–3.0 mm. Average 2.54 mm. The Pilate collection from Opelousas, Louisiana, contained 13 specimens, obtained by sweeping, determined by the writer as this species and these average 2.52 mm. One specimen of what is apparently *fruticola* was reared from similar galls in the acorns of *Quercus texana* Buckley collected at Boerne, Texas, October 25, 1917, giving a second host for this species. The fly emerged in May, 1920. It is probable that *fruticola* has other hosts among the red oaks. The United States National Museum has one specimen from New Boston, Texas, captured March 28, 1907, by F. C. Bishopp. The Biological Survey has three specimens: Falls Church, Virginia, April 30 (E. A. Chapin); Plummer Island, Maryland, April 28 (L. O. Jackson); Dead Run Swamp, Fairfax County, Virginia, April 20 (W. L. McAtee).

CALLIRHYTIS LAPILLULA, new species.

Plate 2, figure 6.

Female.—Thorax reddish-brown, face, antennae, legs and base of abdomen honey-yellow, distal two-thirds of abdomen becoming almost black. Head slightly wider than thorax, finely pebbled, seen from in front elliptical with facial about .75 transfacial and interocular area 1.0–1.1 times as broad as high; seen from above thickness .43 width, barely broadened behind eyes, ocellocular space greater than antennocular, malar space at least .3 eye and with parallel ridges, mandibles 2-toothed, palpi 5- and 3-segmented, antennae 14-segmented, first longest, third and fourth subequal, 5–13 gradually shorter, last about twice preceding and infuscated. Pronotum reticulate. Mesoscutum slightly broader than long, coarsely transversely rugose all over, parapsidal grooves deep, broad, percurrent, their separation behind less than that of the faint parallel lines, lateral lines faint, no median. Scutellum coarsely rugose, with two large, smooth, pear-shaped pits at base, triangular impressions on sides. Propodeum with many ridges radiating from rugose peduncle, the usual carinae parallel, inclosing a space broader than long with trace of a median. Mesopleura rugose, the ridges across middle almost parallel. Hind tarsus shorter than tibia, second and fifth subequal, claws simple. Wing hyaline, veins pale, yellowish, areolet faint, surface short, pubescent, margin not ciliate. Abdomen longer than broad, slightly compressed, second tergite occupying .6 length and with sparse pubescent patches at base, ventral spine not twice as long as broad, ovipositor when dissected out nearly 1.5 times length of antenna. Using width of head as a base the length of mesonotum ratio is 1.2–1.3, antenna 1.9–2.2, ovipositor 2.6–3–4, wing 3.5.

Range in length of 104 pinned specimens 1.8–3.0 mm. Average 2.4 mm.

Type.—Cat. No. 6421, U.S.N.M. Fifty cotypes. Cotypes also in Carnegie Museum, Pittsburgh, Pennsylvania.

Host.—*Quercus bicolor* Willdenow.

Gall.—A mass of thin-walled woody cells inside full-grown acorns of normal appearance or often bulging out on one side (fig. 3). The mass lies below or obliquely to one side of the cotyledons, which are always present and of normal texture. The cells in the mass are more or less separable, each being shaped like an apple seed 4 by 3 by 2 mm. There may be as many as 15 cells in the mass and they separate more or less with the decay of the cotyledons. Occurs in fall. This is the first American instance of a gall of this type in the acorns in one of the white-oak group.

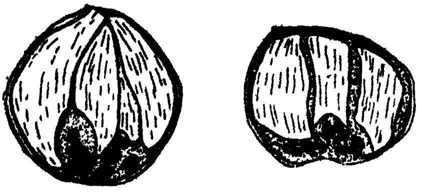


FIG. 3.—CALLIRHYTIS LAPILLULA, NEW SPECIES. CELLS IN ACORNS OF BICOLOR. × 1.

Habitat.—The type locality is Evanston, Illinois, where infested acorns were collected from two trees at various times from 1910 to 1917. In breeding cage it is two years at least before adults appear and the emergence is distributed over more than one season. The larvae transform to pupae and adults in the fall (in September), the flies remaining in the galls to emerge in the spring between April 25 and May 16. One was captured May 28. *Sciara coprophylla* Lintner was also reared from the decaying acorns in spring.

CALLIRHYTIS BALANOSA, new species.

Plate 5, fig. 18.

Female.—Reddish-brown, face and femora yellowish, tibiae, tarsi, antennae, anterior and lateral lines, base of scutellum, propodeum and abdomen much darker, almost piceous, eyes and ocelli black. Head almost as broad as thorax, seen from in front elliptical, broadest below level of antennae, facial line .6 transfacial, interocular area 1.75 times as broad as high, antennocular space less than ocellocular, malar space .5 eye and with groove; seen from above broadened behind eyes, thickness .4 width; mandibles 2-toothed, palpi 5- and 3-segmented, antennae 14-segmented, third equal to one plus two, fourth .74 third, gradually decreasing to 13 which is .37 third, last one and two-thirds times preceding, face pubescent with median elevation below antennae. Mesoscutum broader than long, coriaceous with setigerous punctures, parapsidal grooves deep, smooth, percurrent, broader behind where their separation is greater than that between parallel lines, median shorter than lateral lines, pubescence oppressed, not hiding sculpture. Scutellum .64 as long as mesoscutum, broad, rugose behind, pubescent, pits at base deep, smooth, distinctly separated. Carinae on propodeum curved outwardly, inclosed area broader than high. Mesopleura striate, pubescent above and below. Hind tarsus shorter than tibia, second shorter than fifth, claws simple. Wing hyaline, veins brown, first abscissa of radius rounded, areolet reaching one-sixth and cubitus half way to basal, surface short pubescent, margin not ciliate. Abdomen longer than broad, not compressed, second tergite occupying nearly four-fifths length and with sparsely pubescent patches at base, its hind margin and exposed parts of others microscopically punctate, ventral spine in balsam 2.5 times as long as broad, ovipositor when dissected out slightly longer than antenna, ovarian eggs well developed. Using width of head as a base the length of mesonotum ratio is 1.34, antenna 2.4, ovipositor 2.6, wing 3.5.

Length of two pinned specimens, 3. 2 mm. each.

Type.—Cat. No. 6422, U.S.N.M. Type female.

Host.—*Quercus coccinea* Muenchhausen.

Gall.—Found in spring on the immature acorns of the previous season, pushing out from within the cup and stunting the acorn. When growing in early spring they are fleshy, smooth, greenish, mottled with purple, flattened, and blunt at apex; where they secrete honeydew in such quantities that it often drips to the ground. They become full grown just as the buds are swelling. After they drop to ground in May the thin outer fleshy layer either shrinks up or decays away. The simple thin-walled larval cell inside is relatively large and transversely placed.

Habitat.—The type locality is Fort Sheridan, Illinois, where on June 16, 1917, galls were picked up from ground and a few had not yet fallen from the tree. One fly emerged April 22 and another May 11, 1918, and a pupa was cut out of a gall on September 1 (transforming to an adult by December 1, 1918), indicating that transformation occurs in the fall and emergence in the spring, and that the emergence is distributed over at least two seasons. Similar galls have been seen on the same host in spring at Evanston, Winnetka, Glencoe, and Ravinia, Illinois.

CALLIRHYTIS CARMELENSIS, new species.

Plate 4, figs. 16–17.

Female.—Pale buff, mesonotum, parts of head and of abdomen and tips of antennae becoming cinnamon-buff with eyes, ocelli, tips of mandibles, claws, part of propodeum and dorsal spot on second tergite black. Head and thorax finely pubescent, but not hiding sculpture. Head almost as broad as thorax, seen from in front widest above middle, facial line .64 transfacial, interocular area 1.7 times as broad as high, antennocular space less than ocellocular, malar space .6 eye and with several parallel ridges, broadened behind eyes, thickness less than half width, mandibles 2-toothed, palpi 5- and 3-segmented, antennae 14-segmented, third longest, fourth three-fourths third, gradually decreasing to thirteenth, which is two-thirds as broad as long, last 1.6 times preceding. Mesoscutum uniformly covered with setigerous punctures, broader than long, parapsidal grooves smooth, wider behind, percurrent, their separation behind greater than that between the faint anterior lines, median a mere notch. Scutellum transversely rugose with setigerous punctures, base with two smooth indistinct pits. Carinae on propodeum outwardly curved, inclosing a smooth area broader than high. Mesopleurae aciculate. Hind tarsus shorter than tibia, second and fifth subequal, claws simple, strongly divergent. Wings subhyaline, veins brown, first abscissa of radius angled, areolet reaching one-sixth way to basal, cubitus about halfway, surface densely short brown pubescent, margin not ciliate. Abdomen longer than broad, slightly compressed, second tergite occupying two-thirds its length with sparsely pubescent patches at base, ventral spine in balsam three times as long as broad, ovipositor when dissected out slightly longer than antenna. Using width of head as a base the length of mesonotum ratio is 1.2–1.4, antenna 2.1–2.2, ovipositor 2.4–2.8, wing 3.5–3.9.

Range in length of 12 pinned specimens 3.3–4.1 mm. Average 3.85 mm.

Type.—Cat. No. 18253, U.S.N.M. Type and four paratypes.

Host.—*Quercus agrifolia* Neé and *Quercus wislizeni* A. de Candolle.

Gall.—Ellipsoidal, often laterally, compressed, 5 by 7 mm., produced by the side of small acorns (4 mm. in diameter), pushing out between the acorn and the cup and aborting the acorn. When growing in April they are fleshy, greenish, smooth, and secrete honeydew at apex. They drop in May, and as they harden and shrink a raised transverse band develops near the basal end which is truncate or becomes excavated. The larval cell inside is large and transversely placed.

Habitat.—The type locality is Monterey, California, where galls were collected on *Q. agrifolia* August 14, 1916, and the flies issued March 27, April 10, and April 18, 1918. From *agrifolia* galls collected at Los Gatos May 13, 1918, one fly emerged April 10, 1919, and one April 11, 1920, and three living flies were cut out November 7, 1920. From *agrifolia* galls taken at Carpinteria April 29, 1918, flies emerged March 27 and April 18, 1919. From a *wislizeni* gall collected at Santa Margarita a living fly was cut out December 1, indicating that transformation occurs in the fall, although the emergence is not until spring. Other localities where these galls have been seen on *Q. agrifolia* are: In San Gabriel Canyon in San Gabriel Mountains, Cahuenga Pass in Santa Montica Mountains, Fillmore.

Carpinteria, Santa Barbara, Paso Robles, Paraiso Springs, Palo Alto, hills back of Berkeley, and St. Helena. They were noted on *Q. wislizeni* at Los Gatos, Mount Tamalpais, St. Helena, and Bagby. All localities in California.

CALLIRHYTIS BALANASPIS, new species.

Plate 4, fig. 14.

Female.—Pale reddish-brown, becoming yellowish below, abdomen darker red and almost black dorsally, propodeum, metathorax, at least hind tarsi and tibiae, eyes and ocelli black. Head as broad as thorax, seen from in front widest above antennae, facial line .65 transfacial, interocular area 1.47 times as broad as high, antennocular space equal to ocellocular, malar space .5 eye and with groove, greatly broadened behind eyes, thickness .34 width, mandibles 2-toothed, palpi 5- and 3-segmented, antennae 14-segmented, third longest, fourth .83 third, fifth .7 third, shorter to thirteenth, last one and one-half times preceding and infuscated, frons coriaceous and bare, rest of head pubescent. Pronotum with narrow median bare area. Thorax closely pubescent as in *Disholcaspis* hiding sculpture. Mesoscutum in balsam broader than long, finely rugose, parapsidal grooves percurrent, their separation behind greater than that of parallel lines, no trace of median. Scutellum rugose with two large smooth pits at base. Carinae on propodeum outwardly bent, inclosing a rugose area much wider than high. Mesopleurae aciculate. Hind tarsus shorter than tibia, second shorter than fifth, claws simple. Wings hyaline, veins pale except subcosta and both cross-veins, aerolet large, reaching one-sixth way to basal, surface short pubescent, ciliate only on hind margin of hind wing. Abdomen longer than broad, compressed, second tergite occupying .7 and with sparse pubescent patches at base, its hind margin and exposed parts of rest microscopically punctate and the hind margin of the third tergite at least with parallel shallow-longitudinal indentations, ventral spine three times as long as broad, ovipositor when dissected out longer than antenna. Using width of head as a base the length of mesonotum ratio is 1.26, antenna about 2.5, ovipositor 2.9, wing 2.7.

Length of 3 pinned specimens 3.9–4.1 mm.

Type.—Cat. No. 22911, U.S.N.M. Two cotypes.

Host.—*Quercus marilandica* Muenchhausen.

Gall.—Produced in the fall in October on immature acorns which are about 6 mm. in diameter, the size being characteristically larger than the normal young acorns. It is deeply embedded in the acorn cup beside the acorn, less than half of the gall protruding, and secretes honeydew at apex while growing. When detached the gall is 5 by 7 mm., flattened, tapering at each end. The larval cell is in the middle and placed transversely.

Habitat.—The type material was collected at Texarkana, Arkansas, October 15, 1917. A pupa was cut out March 25, 1919 (transformed by April 29), and two living flies were cut out December 2, 1919. Normal emergence date unknown. The same galls were noted at Ironton, Missouri; Little Rock and Hot Springs, Arkansas; and at Palestine, Texas. Large numbers were seen at Rosslyn, Virginia, and in the District of Columbia on October 10, 1920, when the galls were dropping to the ground and being gnawed open, probably by mice.

CALLIRHYTIS GLANDULUS (Beutenmueller).

Andricus glandulus BEUTENMUELLER, Bull. Brooklyn Ent. Soc., vol. 8, 1913, p. 103, fig. 10.

This species was described from "flies collected on the pine-barrens of New Jersey early in May on twigs of *Quercus prinoides* Willdenow presumably ovipositing in the young acorns." They agreed with a fly reared from an "acorn pip gall" by Riley years before. Hence the gall associated with this species at the time of description was the common acorn gall of the white oaks—an elongated cell in a recess in the side of the acorn cup, this recess being fringed in *Q. bicolor* and smooth in *Q. macrocarpa* and several of the chestnut oaks. Since the fimbriate gall on *bicolor* has recently been reared by the writer and found to produce a very different fly, described in the present paper as *Andricus fimbriatus* Weld, it follows that the gall of *glandulus* is at present unknown. It may be that the similar gall on the chestnut oaks, protruding more than half its length from a recess which is not fringed, is the gall of this species, but no one has yet reared it.

Two cotypes of this species studied by the writer belong in the genus *Callirhytis* and the species is here transferred to that genus. The two specimens measure 3.4 and 3.5 mm. They are closely related to the agamic females of *Callirhytis operator* (Osten Sacken).

CALLIRHYTIS OPERATOR (Osten Sacken), agamic.

Plate 4, fig. 15.

The original material of these acorn pip galls was collected on August 23, 1871, at Waterbury, Connecticut, on *Q. ilicifolia* during Riley's visit to Bassett. Bassett kept his galls over a year, and rearing nothing threw them away. Riley kept his longer, and the second spring succeeded in rearing the maker, "the flies emerging in early spring just as the oak buds were bursting." The United States National Museum has six pinned flies bearing Riley's label "467, April 5, 1873, Acorn pip gall." These are the original flies reared by Riley nearly 20 months after the galls were collected, and Riley's original notes are on file in the Bureau under U. S. D. A. No. 467. They represent the alternating generation of *operator* and established the alternation of generations in the Cynipidae. They range from 3.1–3.9 mm. Average 3.3 mm. Two others in balsam give the following ratios, using width of head as a base: Length of mesonotum 1.2, 1.23; antenna 2.04, 2.03; ovipositor 3.02, 3.01; wing 3.59, 3.68. Some of these reared flies were submitted (July 10, 1873, says Kinsey) to Bassett to be compared with flies Bassett had taken ovipositing in buds of *ilicifolia* on May 4, 1873. They seemed to Bassett to agree with his and probably were returned to Riley again. In the United States National Museum are two flies labeled in Bassett's hand and sent by Bassett to Ashmead "*Andricus* (*Callirhytis*) *operatola* Riley. The one-gendered form of *operator* taken ovipositing in buds of *Q. ilicifolia.*" They measure 3.25 and 3.75 mm. They seem to the writer to agree with the flies Riley reared.

In writing of the species over a quarter of a century later, however, Bassett was in error in saying that Riley had reared and sent him flies the *next* spring, and the long period of development of the agamic as compared with the sexual generation seems to have made little impression. The agamic flies preserved in Philadelphia as the types of this species seem to the writer to represent two species—two specimens agreeing with those in the United States National Museum and with those Riley reared. Among the duplicates there was a vial determined by Bassett as this species, containing 11 specimens. These the writer obtained permission to mount. They were taken ovipositing in buds April 24, 1892. Six of these seem to be the agamic form of *operator.*

In writing of the life history of this species Kinsey is in error in stating that the sexual females oviposit in June in the "very small, young acorns." There are two kinds of young acorns on the tree at that date and it is the 1-year-old acorns that are attacked. The writer has seen them ovipositing in these immature acorns on June 30, 1909, at Miller, Indiana. These acorns are at that date about 8 mm. in diameter and almost entirely inclosed in the nearly spherical cup with only the stigmas protruding. The female backs up toward the stigma, slipping the ovipositor down between acorn and cup. The galls occur then in acorns of the current year's crop and mature earlier than is popularly supposed, being full grown and beginning to drop at Ithaca, New York, late in July. The base of the gall becomes delequescent and the normal gall slips out, where its outer layers soon disintegrate, leaving but the transversely placed thin white inner cell. If parasitized, however, they remain and fall with the acorns, and it is these that are commonly observed and collected and which fail to yield the maker.

CALLIRHYTIS MIDDLETONI, new species.

Plate 5, fig. 19.

Female.—Pale reddish-brown, head and legs inclining to buff, tips of antennae, anterior and parallel lines, foveae and propodeum more or less infuscated. Head narrower than thorax, coriaceous, short pubescent except above antennae; seen from above twice as broad as long; seen from in front interocular space .57 transfacial and area 1.55 times as broad as high, malar space .55 eye and with groove, antennocular not quite equal to ocellocular, postocellar greater than ocellocular, mandibles 2-toothed, palpi 5- and 3-segmented, antennae 14-segmented, lengths in balsam as 23:10:28:22:18:17:14:12:11:11:11:10:9:14, first stoutest, flagellum only slightly stouter toward apex. Thorax covered with short close-set pubescence not hiding sculpture. Mesoscutum broader than long, coriaceous, parapsidal grooves straight, dull, with transverse ridges, obliterated anteriorly, trace of median posteriorly, antenna and lateral lines distinct. Scutellum rugose, pits large and smooth, triangular impressions on sides. Carinae on propodeum straight for two-thirds their length and converging slightly above. Hind tarsus shorter than tibia, second shorter than fifth, claws simple. Wing subhyaline, veins beyond second cross-vein faint, apical abscissa of subcosta a mere spur like the one at angle of first abscissa of radius, areolet indistinct, clear spot above costal hinge, surface pubescent, margin not ciliate. Abdomen longer than high, slightly compressed, second tergite occupying four-fifths with large pubescent areas on sides, ventral spine horizontal, prominent, tapering, ovipositor when dissected out longer than antenna. Using width of head as a base the length of mesonotum ratio is 1.3, antenna 2.1–2.8, ovipositor 2.2–3.0, wing 3.5–3.6.

Length of 36 pinned specimens 3.5–4.1 mm. Average 3.8 mm.

Type.—Cat. No. 22910, U.S.N.M. Twenty-five cotypes.

Host.—*Quercus phellos* Linnaeus.

Gall.—Green, 6 by 7 mm. and 5 mm. thick, surface rough with blunt warty elevations, apex slightly prolonged, monothalamous, wall 1 mm. thick. They drop from the twigs in early May. No investigation was possible and it is not known whether this is a bud or acorn gall. The fly is so closely related to species from pip galls on young acorns that it seems probable that this is an acorn gall. After the galls drop an outer fleshy layer decays away, leaving a stony shell with sharp longitudinal ridges.

Habitat.—The type locality is Washington, District of Columbia. This gall was first called to the author's attention by Mr. J. C. Crawford May 6, 1914, when a large number of galls were collected on the ground under a large tree on the Mall between the Natural History Building of the United States National Museum and the Smithsonian Building. The author, however, failed to rear it. On the same date Mr. William Middleton collected galls from same tree. Adults emerged April 9 and April 16, 1915, and one April 17, 1916. These are recorded under Hopkins U. S. No. 12036. Mr. Middleton had also collected galls under the same tree May 2 and May 10, 1912, and pupae were found in the galls in September, 1913, and adults in November, 1913. The flies emerged March 31, 1914. The species evidently transforms in the galls that fall and adults emerge the next spring, the emergence being distributed over two seasons. Galls collected under same tree April 29, 1920, gave adults in the latter half of March, 1921. The new galls on this tree began to drop by April 15, 1921.

CALLIRHYTIS BALANOPSIS, new species.

Plate 3, fig. 8.

Female.—Reddish-brown with black markings—eyes, about mouth, areas inclosing lateral lines, anterior two-thirds of area between parapsides, metathorax and propodeum, sternum, posterior two thirds of abdomen. Head narrower than thorax, coriaceous, from above twice as broad as long, from in front interocular space .6 transfacial and area 1.5 times as broad as high, facial .64 transfacial, postocellar longer than antennocular or ocellocular which are subequal, malar space .4 eye and with groove, mandibles 2-toothed, palpi 5- and 3-segmented, antennae 14-segmented, lengths of first five as 23 : 9 : 18 : 17 : 13 and of last two as 7 : 13, 6–13 gradually decreasing in length. Mesoscutum broader than long, coriaceous, with appressed pubescence not hiding sculpture, parapsidal grooves deep, smooth and shining posteriorly, obliterated anteriorly, slightly converging as they approach scutellum, anterior and lateral lines shining. Scutellum finely rugose, the transverse pits at base deep and smooth, disk almost circular. Carinae on propodeum bowed out, inclosed area broader than high. Hind tarsus equal to tibia, second shorter than fifth, claws simple. Wing hyaline, subcosta and cross-veins brown, others pale, first abscissa of radius angled, areolet reaching about one-fourth and cubitus about three-fourths way to basal, surface very short pubescent, margin not ciliate. Abdomen longer then broad, laterally compressed, second tergite occupying .73 with pubescent areas on sides, ventral spine prominent, horizontal, in balsam nearly three times as long as broad, ovipositor when dissected out one and one-sixth times as long as antenna. Using width of head as a base the length of mesonotum ratio is 1.4, antenna 2.0, ovipositor 2.3, wing 4.2.

Length of 5 pinned specimens 3.0–3.8 mm. Average 3.4 mm.

Type.—Cat. No. 22909, U.S.N.M. Two cotypes.

Host.—*Quercus marilandica* Muenchhausen.

Gall.—Produced in fall on small acorns of current season, sometimes three or four on one acorn. They are green, smooth, 4 mm. in diameter, laterally compressed and elongated slightly at base and apex. They secrete copious quantities of honeydew while growing and later fall to the ground.

Habitat.—The type material was collected at Ironton, Missouri, October 5, 1917, and the flies emerged March 25–April 18, 1919. These galls have been noted at Texarkana, Arkansas; Palestine and Cuero, Texas; Troy and Dothan, Alabama; and Marianna and River Junction, Florida.

CALLIRHYTIS BALANOIDES, new species.

Plate 3, fig. 7.

Female.—Red anterior and lateral lines, base of scutellum, dorsal part of abdomen, tibiae and tarsi infuscated. Head as broad as thorax, coriaceous, seen from above widened behind eyes, thickness .4 width; seen from in front widest above level of antennae, facial line .73 transfacial, interocular area 1.59 times as broad as high, antennocular and ocellocular spaces equal, malar space .5 eye and with groove, mandibles 2-toothed, papli 5- and 3-segmented, antennae 14-segmented, third longest, fourth .83 third, gradually decreasing to 13, last 1.4 times preceding, face slightly pubescent. Pronotum finely rugose. Mesoscutum dull, coriaceous and finely rugose with inconspicuous setigerous punctures, parapsidal grooves shallow, sculptured, percurrent, separation behind greater than that between anterior lines, pubescence not hiding sculpture. Scutellum rugose with two large smooth oval pits at base, triangular impressions on sides. Carinae on propodeum outwardly curved, inclosing a rugose area slightly broader than high. Mesopleura striate. Hind tarsus shorter than tibia, second shorter than fifth, claws simple. Wing hyaline, subcosta and cross-veins brown, rest paler, first abscissa of radius arcuate, areolet reaching one-seventh and cubitus about one-half way to basal, surface short pubescent, margin not ciliate. Abdomen longer than high, slightly compressed, second tergite occupying .7 its length with sparsely pubescent patches at base, ventral spine in balsam 2.5 times as long as broad, ovipositor when dissected out about 1.2 times length of antenna. Using width of head as a base the length of mesonotum ratio is 1.4, antenna 2.8, ovipositor 3.4, wing 3.36.

Length of one pinned specimen 3.1 mm.

Type.—Cat. No. 23170, U.S.N.M. Type female. Paratype in balsam with author.

Host.—*Quercus velutina* Lamarck.

Gall.—Produced in autumn on small acorns of the current season, bursting out between the acorn and the cup. They secrete honeydew while growing. There are sometimes 2 to 3 galls on one acorn. When detached they are triangular in outline, flattened, the larval chamber transversely placed in the upper half of the gall and below it a spongy region which decays away after the gall drops, giving it an excavated base.

Habitat.—The type flies were bred from galls collected October 5. 1917, at Ironton, Missouri, the flies issuing May 5, 1919. Similar galls have been seen at Ithaca, New York; Glencoe, Illinois; East Falls Church, Virginia; and at Wharton, Texas.

CALLIRHYTIS PATIENS (Bassett).

Andricus patiens BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 312.

This species was described from over 50 specimens taken ovipositing April 8–11, in the buds of *Quercus ilicifolia.* The types have the general habitus of the species from pip galls in acorns and a life history similar to that of *operator* (Osten Sacken) is suggested. It remains for some one in the region where *ilicifolia* occurs to collect acorn galls and rear this species and work out the life history. As the tarsal claws are simple the species is here transferred to *Callirhytis.* Using the width of the head as a base, the ratio of the length of mesoscutum is 1.25, antenna 2.12, ovipositor 3.09, wing 3.8. Range in size of five paratypes 2.4–3.4 mm. Average 2.9 mm.

CALLIRHYTIS PERDITOR (Bassett).

Andricus perditor BASSETT, Trans. Amer. Ent. Soc., vol. 26, 1900, p. 113.

Acraspis perditor Bassett, DALLA TORRE, and KIEFFER in Wytsman Gen. Ins. Cynipidae, 1902, p. 58.—DALLA TORRE and KIEFFER, Das Tierreich, Lief. 24, 1910, p. 412.

Like *balanosa* Weld, this species is described as producing early spring galls which secrete honeydew on immature acorns of the previous season, but on a different host, *Quercus ilicifolia* Wangenheim instead of on *Quercus velutina* Lamarck. The species was described from a single female (cut out of a gall) whose wings were "not fully expanded." This has led Dalla Torre and Kieffer to transfer it erroneously to the genus *Acraspis.* The type is in the collection of the American Entomological Society and it is not an *Acraspis*, as the wings are normally developed but crumpled. This type was compared with *balanosa*, *balanoides*, *balanaspis*, and *balanopsis* of the present paper and found to be smaller than any of these species and closest to *balanoides*. As the tarsal claws seem to be simple, the species is here transferred to *Callirhytis*.

Genus ANDRICUS Hartig.

ANDRICUS FIMBRIATUS, new species.

Plate 1, fig. 3, and plate 3, fig. 11.

Agamic female.—Black, flagellum and legs brownish. Head as broad as thorax, frons coriaceous, face smooth with setigerous punctures, pubescence white, seen from in front widest above antennae, facial line .74 transfacial, intercular area 1.36 times as broad as high, antennocular less than ocellocular, malar .5 eye and without groove, seen from above widened behind eyes, thickness .43 width with occiput only slightly concave, mandibles 2-toothed, palpi 5- and 3-segmented, antennae 13-segmented, third longest, 4–6 subequal and three-fourths third, decreasing to 12, last twice as long as preceding. Thorax with white pubescence but not hiding sculpture. Mesoscutum broader than long, shining, finely coriaceous in balsam with setigerous punctures, parapsidal grooves deep, smooth, narrower and vanishing in front, their separation behind equal to that at hind end of the smooth anterior lines, median not reaching to anterior lines. Lateral lines bare. Scutellum becoming rugose behind, pits at base smooth, deep triangular impressions on sides. Carinae on propodeum slightly bent out and inclosing a smooth area narrowed a little above. Mesopleura with large bare polished area. Hind tarsus equal to hind tibia, second shorter than fifth, claws with tooth. Wings hyaline, veins brownish, first abscissa of radius curved, radial cell ratio (length divided by width) 3.4, areolet reaching one-fifth and cubitus three-fourths way to basal, surface pubescent, margin ciliate. Abdomen longer than broad, slightly compressed, smooth and shining, second tergite occupying about four-fifths and the third the rest, second with narrow pubescent patches at base, the hind margin making an angle of 45 degrees, ventral spine horizontal, in balsam 3.75 times as long as broad, ovipositor when dissected out one and one-half times antenna, ovarian eggs well developed. Using width of head as a base the length of mesonotum ratio is 1.38, antenna 2.0, ovipositor 3.1, wing 3.89.

Length of 13 pinned specimens 2.75–3.5 mm. Average 3.2 mm.

Runs in the Tierreich key to *pruinosus* Bassett, from which it is distinguished by its larger size, darker veins, larger areolet, and longer cubitus.

Type.—Cat. No. 23225, U.S.N.M. Seven cotypes.

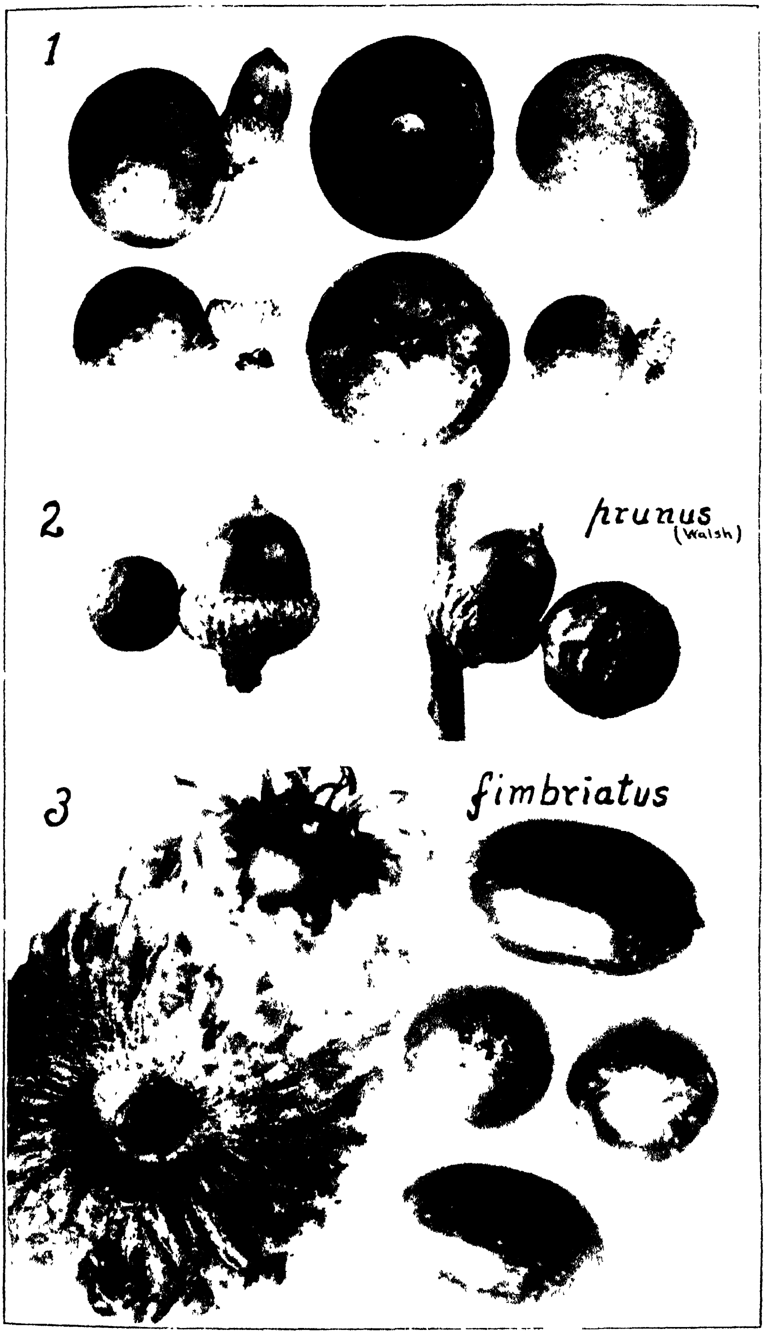
Host.—*Quercus bicolor* Willdenow.

Gall.—This fimbriate-cup gall on *bicolor* was well described by Riley in 1877 along with a similar one but protruding farther, from a smooth cup on *Q. prinoides.* Both have often been referred to in literature frequently under the names *glandulus* and *glandulosus.*

The fly described as *Andricus glandulus* Beutenmueller, of which the author has a cotype, and associated with the above gall is a red species from an unknown gall. It belongs to the genus *Callirhytis* and is closely related to *C. operatola*—the agamic generation of *C. operator* (Osten Sacken).

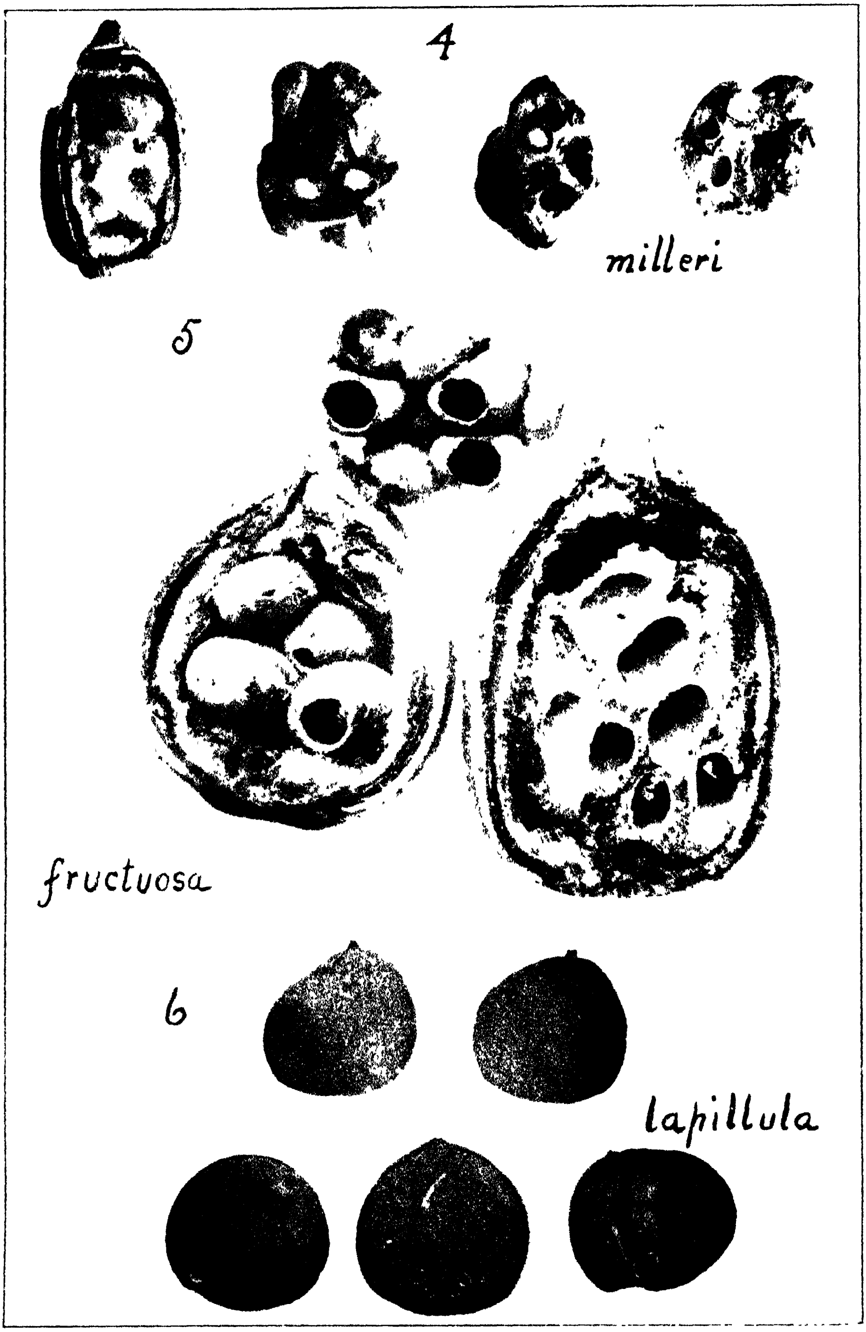
Habitat.—The type material was collected at Wilmette, Illinois, September 1, 1917, when the galls were dropping to the ground. When some of the galls were cut open just a year later about half still contained larvae and half pupae and adults. One fly emerged in cage March 25 and one April 18, 1919. On December 2, 1919, five living flies were cut out. Transformation thus occurs in fall and emergence in the spring and the emergence is distributed over two seasons. As the emergence is before flowering there must be an alternating generation in a vernal gall. In 1908 the galls had nearly finished dropping by September 9 and in 1912 they had all dropped by September 10. They have been seen also at Evanston, Kenilworth, and Glencoe, Illinois, and at Porter, Indiana. The herbarium at Shaw Botanical Garden, St. Louis, has a specimen from Kimmswich, Missouri, collected in 1860.

The writer has field notes on a similar gall on nine other white oaks of the eastern United States where the recess in which the gall rests is not fimbriate and the gall protrudes half its length or more. See plate 3, figure 12, on *prinus* and figure 13 on *macrocarpa.* As he has not been able to rear any of these as yet it is not known whether any or all of these are caused by the above-described species or which if any is *glandulus* Beutenmueller.



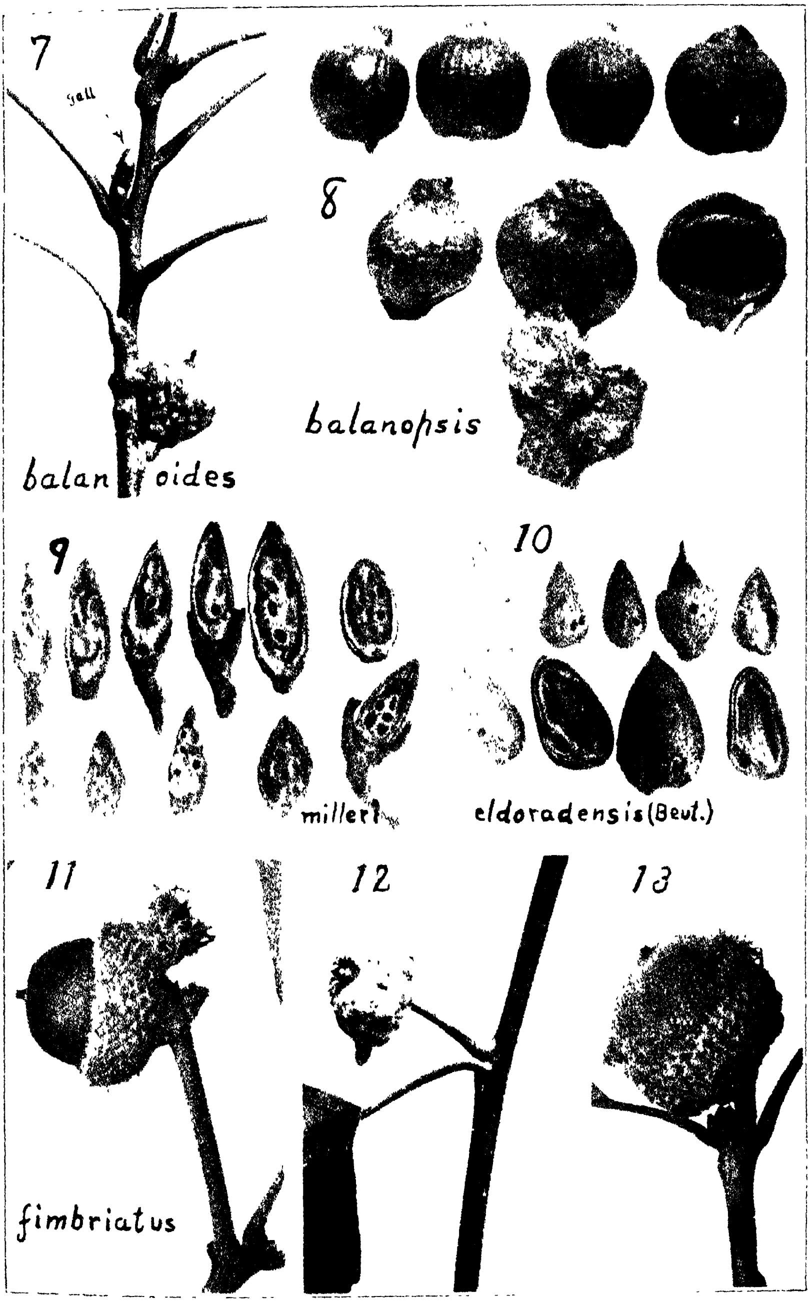
GALLFLIES OF THE FAMILY CYNIPIDAE

FOR EXPLANATION OF PLATE SEE PAGE 30



GALLFLIES OF THE FAMILY CYNIPIDAE.

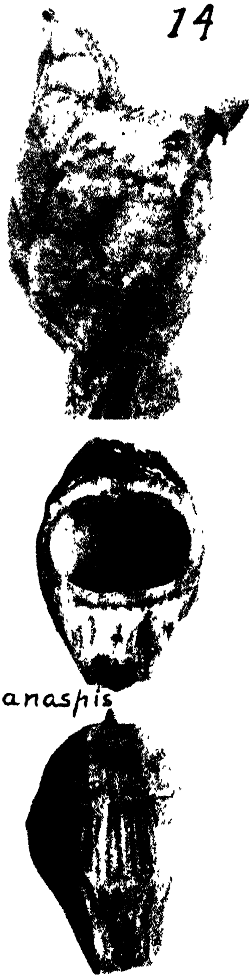
FOR EXPLANATION OF PLATE SEE PAGE 30



GALLFLIES OF THE FAMILY CYNIPIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 31

14

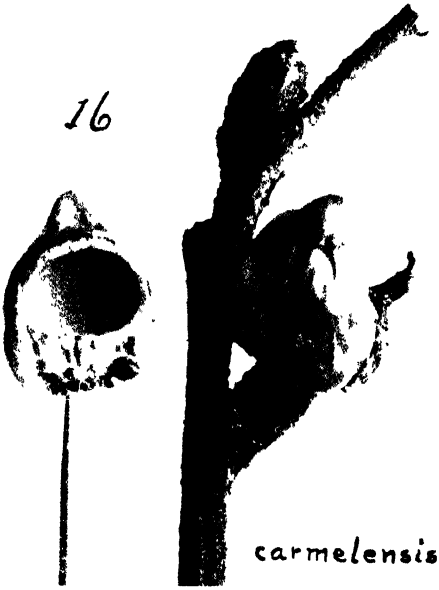


balanaspis

15

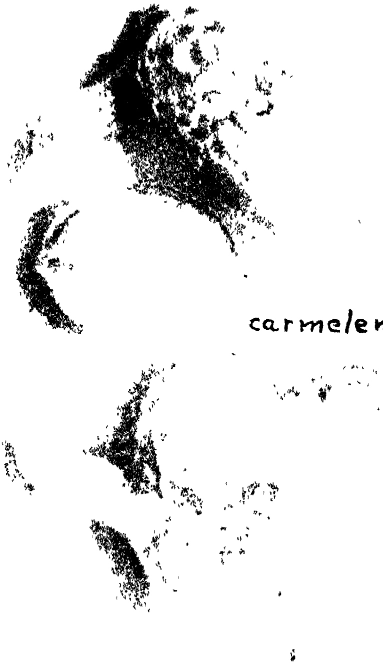
operator (OS) agamic gen.

16



carmelensis

17

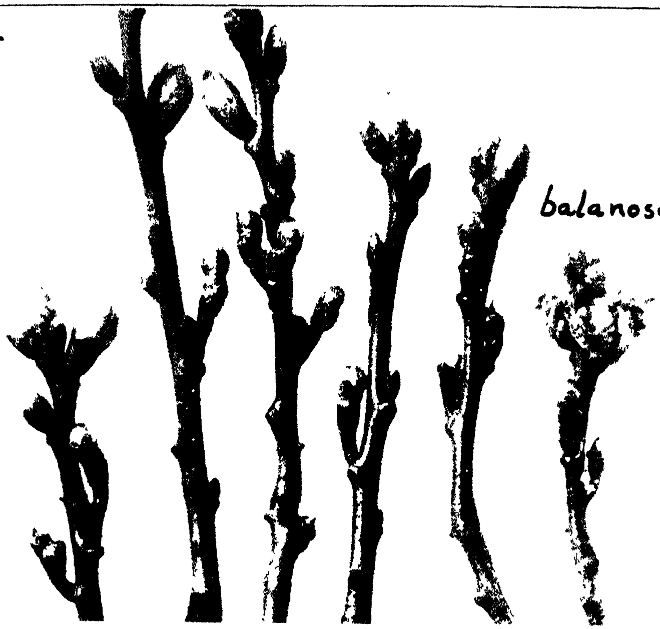


carmelensis

GALLFLIES OF THE FAMILY CYNIPIDAE.

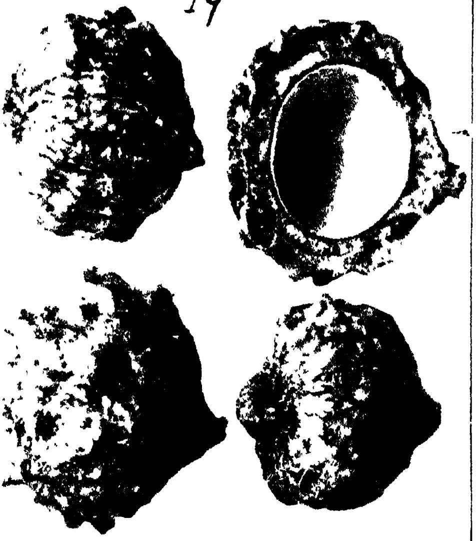
FOR EXPLANATION OF PLATE SEE PAGE 31.

18



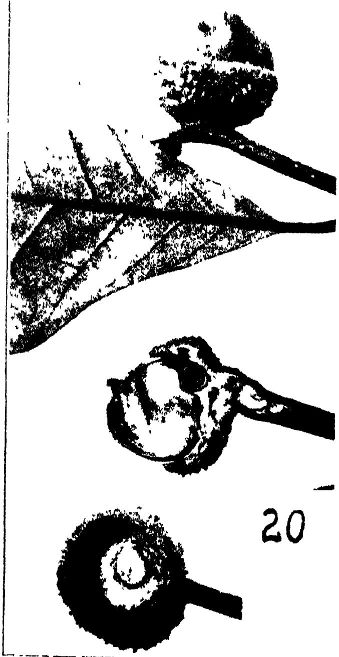
balanosa

19



middletoni

20



GALLFLIES OF THE FAMILY CYNIPIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 31

EXPLANATION OF PLATES.

Figures natural size except where otherwise noted.

PLATE 1.

Fig. 1. Undescribed *Amphibolips* gall on acorns of *Quercus texana* Buckley.
2. Galls of *Amphibolips prunus* Walsh on *Q. velutina.*
3. Galls of *Andricus fimbriatus* Weld × 5 on *Q. bicolor.*

PLATE 2.

Fig. 4. Galls of *Callirhytis milleri* Weld in acorns of *Q. californica.*
5. Galls of *Callirhytis fructuosa* Weld × 5 in acorns of *Q. coccinea.*
6. Galls of *Callirhytis lapillula* Weld in acorns of *Q. bicolor.*

PLATE 3.

Fig. 7. Galls of *Callirhytis balanoides* Weld in immature acorns of *Q. velutina* in autumn.
8. Galls of *Callirhytis balanopsis* Weld × 5 on immature acorns of *Q. marilandica* in autumn.
9. Galls of *Callirhytis milleri* Weld in acorns of *Q. wislizenii* (the two acorns on right) and *Q. agrifolia.*
10. Galls of *Biorhiza eldoradensis* (Beutenmueller) in acorns of *Q. wislizenii* (below) and *Q. agrifolia* (above).
11. Gall of *Andricus fimbriatus* Weld on cup of *Q. bicolor.*
12. Undescribed species in cup of *Q. prinus.*
13. Undescribed species in cup of *Q. macrocarpa.*

PLATE 4.

Fig. 14. Galls of *Callirhytis balanaspis* Weld × 5 on immature acorns of *Q. marilandica* in autumn.
15. Galls of *Callirhytis operator* (Osten Sacken) agamic generation on *Q. rubra.*
16. Gall of *Callirhytis carmelensis* Weld × 5 on *Q. agrifolia.* Dried specimen.
17. Fresh galls of *Callirhytis carmelensis* Weld × 5 on *Q. agrifolia.*

PLATE 5.

Fig. 18. Galls of *Callirhytis balanosa* Weld on immature acorns of *Q. coccinea* in spring.
19. Galls of *Callirhytis middletoni* Weld × 5.
20. Undescribed gall in tissue of acorn cup of *Q. bicolor.*

SPECIES INDEX.

This index includes all species referred to in this paper. Generic names are in boldface, specific in Roman.

	Page.
Amphibolifas Reinhard	3
Andricus Hartig	29
balanaspis, new species, Callirhytis	22
balanoides, new species, Callirhytis	27
balanopsis, new species, Callirhytis	26
balanosa, new species, Callirhytis	19
Biorhiza Westwood	5
blastophaga (Ashmead), Callirhytis	11
Callirhytis Foerster	7
carmelensis, new species, Callirhytis	20
clarkei Bassett, Callirhytis	11
congregata (Ashmead), Callirhytis	9
corrugis (Bassett), Callirhytis	16
crypta (Ashmead), Callirhytis	10
cryptica Weld, Callirhytis	10
eldoradensis (Beutenmueller), Biorhiza	5
fimbriatus, new species, Andricus	29
flora Weld, Callirhytis	11
fructuosa, new species, Callirhytis	14
fruticola Ashmead, Callirhytis	17
fuliginosa Ashmead, Amphibolips	4
gainesi Bassett, Amphibolips	4
glandulus (Beutenmueller), Callirhytis	23
lapillula, new species, Callirhytis	18
medullae (Ashmead), Callirhytis	10
middletoni, new species, Callirhytis	25
milleri, new species, Callirhytis	11
modesta (Osten Sacken), Callirhytis	10
myrtifoliae (Beutenmueller), Callirhytis	11
nigrae (Osten Sacken), Callirhytis	11
obtusilobae (Bassett), Callirhytis	10
operator (Osten Sacken) agamic, Callirhytis	23
operator (Osten Sacken) sexual, Callirhytis	10
parva Weld, Callirhytis	10
patiens (Bassett), Callirhytis	28
perditor (Bassett), Callirhytis	28
petrina, new species, Callirhytis	13
petrosa, new species, Callirhytis	15
prunus (Walsh), Amphibolips	5
pulchra (Bassett), Callirhytis	10
quercus phellos (Osten Sacken), Callirhytis	10
tuberosa Bassett, Callirhytis	10
tumifica (Osten Sacken), Callirhytis	10
turneri (Ashmead), Callirhytis	10

NEW TERMITES FROM HAWAII, CENTRAL AND SOUTH AMERICA, AND THE ANTILLES.

By Thomas E. Snyder,

Of the Bureau of Entomology, United States Department of Agriculture.

This paper describes 15 new termites and a new variety, some of which are of particular interest from the standpoint of comparative morphology and of phylogeny. The following is a list of the new termites and their geographical distribution:

List of new species.

Kalotermitidae	*Kalotermes immigrans* Snyder	HAWAII	Oahu, Honolulu.
	Neotermes connexus Snyder		Kauai.
	Cryptotermes connexus, var. *major* Snyder		Hawaii, Kaiwiki.
	Cryptotermes piceatus Snyder		Oahu, Honolulu.
	Cryptotermes rospigliosi Snyder	SOUTH AMERICA	Peru.
	Kalotermes cubanus Snyder	ANTILLES	Cuba.
	Kalotermes tuberculifrons Snyder	CENTRAL AMERICA	Mexico.
	Kalotermes montanus Snyder		Mexico.
	Cryptotermes thompsonae Snyder		Panama
Termitidae	*Coptotermes niger* Snyder		Panama.
	Coptotermes crassus Snyder		Spanish Honduras.
	Armitermes intermedius Snyder		Spanish Honduras.
	Constrictotermes (*Tenuirostritermes*) *incisus* Snyder		Spanish Honduras.
	Constrictotermes (*Tenuirostritermes*) *briciae* Snyder		Spanish Honduras.
	Anoplotermes gracilis Snyder		Panama.
	Anoplotermes manni Snyder		Spanish Honduras.

As classified systematically, there are eight new species and a new variety in the family Kalotermitidae and seven new species in the family Termitidae.

Genus KALOTERMES Hagen.

This genus contains a very large number of species from widely different parts of the world. It is well named, since many beautiful and striking species are included. The largest and most primitive species, *Kalotermes occidentis* Walker, occurs in North America.

Nils Holmgren has subdivided the genus *Kalotermes* into many subgenera, all of which are not adopted in this paper, since many of his subgeneric characters are only constant for the soldier caste.

The third segment of the antenna of the soldier of species of *Kalotermes* is usually enlarged and modified; the legs of the soldier have the femora swollen.

Species of *Kalotermes* are very destructive to the interior woodwork and furniture of buildings and other timber. They are able to infest wood directly and can survive in dry wood. Species of this genus do not normally burrow in the ground; occasionally they construct galleries through the soil in artificial colonies in captivity. As in other Kalotermitidae, the impressed pellets of excrement are characteristic.

KALOTERMES IMMIGRANS, new species.

Winged adult.—Head castaneous-brown, paler posteriorly, longer than broad, rounded posteriorly, with scattering but fairly long hairs. Labrum light yellow-brown, broader than long, broadly rounded anteriorly, with long hairs. Compound eye large, larger than in *Kalotermes marginipennis* Latreille, not round, separated from the lower (lateral) margin of the head by a distance less than its diameter. Ocellus elongate, close and placed obliquely to eye.

Antennae yellowish-brown, broken; with long hairs; third segment darker, long (much longer than in *marginipennis*), slender, clavate longer than second and fourth segments; second segment shorter than fourth; antenna becoming stouter toward apex.

Pronotum slightly lighter colored than head; broader than head; twice as broad as long, the broadest part being nearer to posterior margin than in *marginipennis;* concave (emarginate) at anterior margin, posterior margin almost straight; lateral margins somewhat angularly rounded posteriorly. Pronotum with light-yellow long hairs on margins.

Wing pale but costal veins[1] yellow-brown, radial sector with 5 branches to costa, branches longer than in *marginipennis;* median vein nearer to radial sector, branched (twice) or not; reaching apex; cubitus with 13 branches, not quite reaching apex (pl. 4, fig. 15). Wing stub or scale[2] slightly longer than pronotum.

Abdomen with dorsum same color as pronotum, with long hairs, ventral surface paler.

Legs paler in color than abdomen.

Measurements.

Length of entire adult with wings: 12 mm.
Length of entire dealated[3] adult: 5.5 mm.
Length of head[4]: 1.40 mm.
Length of pronotum: 0.705 mm.
Length of hind tibia: 1.070 mm.
Length of wing: 9.5–11 mm.
Width of head (at eyes): 1.102 mm.
Diameter of eye (long diameter): 0.307 mm.
Width of pronotum (at broadest point): 1.205 mm.
Width of wing (at widest point): 2.90 mm.

---

[1] "Costal veins" refer to the costa and subcosta or radial sector.
[2] "Wing scale" refers only to the base of the mesothoracic wing.
[3] The adult after the loss of the wings is termed "dealated."
[4] From tip of labrum to posterior margin.

Closely related to *Kalotermes marginipennis* Latreille but darker colored.

A single specimen, possibly a variety, collected at Waikiki by Ashmead is lighter colored, longer, with longer, wider head, and has the pronotum relatively shorter in proportion to its width; the wings are also longer; membrane of wing rugose between median and subcosta. More material is needed to determine whether this is merely a variety or a distinct and new species.

Soldier.—Head yellow-brown, anterior portion castareous-brown, posterior portion pale; elongate, normally not twice as long as broad, but forms occur in which the head is nearly twice as long as broad: lateral margins nearly parallel but slightly broader anteriorly; posterior margin rounded; head with scattered but fairly long hairs. Anterior portion (front) slightly sloping forward and depressed in middle, with V-shaped dark area.

Mandibles black, not as long as width of head, stout at base, points curved in at apex, marginal teeth variable. Labrum yellow-brown, broader than long, constricted at tip, nearly truncate, with long hairs at tip.

Eye spot pale, small, separated from rim of antennal socket by a distance equal to its diameter.

Gula fairly broad in middle, at middle being about half the width in front.

Antennae pale yellow-brown, longer than mandibles, as long as width of head, 13 segments, pubescent; third segment elongate, slender, clavate, with chitin deeply colored, longer than fourth and fifth together: last segment slender and subovate.

Pronotum yellow-brown, not twice as broad as long, deeply emarginate posteriorly (angles more acute than in *marginipennis*), convex posteriorly; widest at anterior portion, anterior margins high; narrowed, but not much rounded toward posterior margin, concave in middle, where narrowest. Anterior margin darker and slightly serrate. Pronotum with scattered but fairly long hairs.

Abdomen with dorsum slightly paler than pronotum, pubescent, hairs fairly long.

Legs with femora swollen, tibiae darker.

Measurements.

Length of entire soldier: 7–9.5 mm.
Length of head with mandibles: 3.5–4.7 mm.
Length of head without mandibles: 2.4–3.2 mm.
Length of left mandible: 1.1–1.40 mm.
Length of pronotum (at corners): 1.20–1.50 mm.
Length of protonum (at middle): 0.90–1.20 mm.
Length of hind tibia: 1.102–1.60 mm.
Width of head: 1.75–2.10 mm.
Width of pronotum: 1.75–2.10 mm

Soldier figured by D. T. Fullaway but referred to *Kalotermes marginipennis* Latreille.[5]

The locality where the three soldiers upon which this description is based were found is Honolulu, Oahu, Hawaii, D. T. Fullaway, collector, "27/1/'19." These soldiers were not found with the above typical winged adult and possibly are not this species, but are presumed to be, since *immigrans* is the only *Kalotermes* known from Hawaii.

Type locality.—Honolulu, Oahu, Territory of Hawaii.

Described from a series of winged and deälated adults collected at the type locality by D. T. Fullaway on "31, VII, '18." Winged adults were also collected at Waikiki, Oahu, and Kauai, Territory of Hawaii.

Type, winged adult.[6]—Cat. No. 24562, U.S.N.M.

Biological notes.—This new species of *Kalotermes* has been referred to in literature as *K. marginipennis* Latreille; it is believed to have been introduced into the Hawaiian Islands. Nevertheless, this termite has been present at least since 1883 (Fullaway, 1920). According to Dr. O. H. Swezey, this species (*K. immigrans*) is found in dead trees in the lowlands but not at high elevations; it occurs in telephone poles and other timbers and is said to be injurious to the woodwork and furniture in buildings. However, there are no definite records of such injury by this species, since the *Cryptotermes* which occurs in buildings (*C. piceatus* Snyder) was not known as such until a few years ago (about 1918); since then any colony which Doctor Swezey has examined occurring in furniture or the woodwork of buildings has either been of this *Cryptotermes* or of *Coptotermes intrudens* Oshima; if the colonies were large they were of the latter species.

K. immigrans Snyder swarms in June ("31, 1918," Fullaway), at Oahu, but winged adults were also collected on August 1, 1901, at Kauai (elevation 150 meters or 500 feet) by Wm. H. Ashmead. Like most species in the family *Kalotermitidae*, there is probably a long and irregular period during which winged adults emerge and fly about.

References to biological or economic literature.

1919. SWEZEY, O. H. Notes and Exhibitions. Termites in telephone poles. Proc. Hawaiian Ent. Soc., vol. 4, no. 1, June, p. 182. (*Calotermes marginipennis*, *Cryptotermes* sp. and *Coptotermes* sp. in poles broken down during recent severe windstorm. *Coptotermes* most destructive. *Cryptotermes* had eaten from top to bottom of a 20 foot pole which had been up only five years; they fed chiefly on the outer part of the pole.)

1920. FULLAWAY, D. T. Termites or white ants in Hawaii. The Hawaiian Forester and Agriculturist, vol. 17, No. 10, pp. 294–301, Oct.

---

[5] The Hawaiian Forester and Agriculturist, October, 1920, vol. 17, No. 10, p. 297, fig. 2.

[6] Where the sex of the type is not indicated, this is due to the fact that such determination only could be made at the risk of the destruction of the type.

KALOTERMES MONTANUS, new species.

Winged adult.—Head yellow-brown (pale castaneous between eyes), longer than broad, but short, broadest back of eyes; rounded posteriorly; with scattered but fairly long hairs. Eyes not quite round, large, projecting, distance from lateral margin of head equal to their diameter; ocellus large, elongate, placed obliquely to compound eye, at a distance less than its small diameter. Post-clypeus pale yellow, hind margin a straight line. Labrum broader than long, broadly rounded anteriorly, with long hairs.

Antennae yellow-brown, paler than head, longer than head, with 18 segments; with long hairs; first segment elongate, stout, cylindrical; second shorter, clavate, slightly longer than third, which is more slender and has the chitin more deeply colored; fourth shorter, wedge-shaped; fifth slightly longer; last segment slender, very short and subovate; antennae stouter toward tip.

Pronotum approximately same color as head, broader than head (not including the eyes), nearly twice as broad as long, broadest in middle, emarginate at anterior margin, posterior margin almost straight, lateral margins rounded, with long hairs.

Wings pale, costal veins dark yellow-brown; wing longer and broader than in *marginipennis;* radial sector with 6 long branches to the costa; branches between subcosta and median veins; median about half way between radial sector and cubitus, doubly branched, and does not extend to apex of wing; cubitus with 17 branches or subbranches (pl. 4, fig. 14).

Wing scale is longer than the pronotum.

Dorsal surface of abdomen with same color as pronotum, ventral surface paler, abdomen with long hairs.

Legs paler, not particularly short or stout.

Measurements.

Length of entire winged adult: 18.0 mm.
Length of entire deälated adult: 6.5–7 mm.
Length of head: 2.20 mm.
Length of pronotum: 1.10 mm.
Length of hind tibia: 1.30 mm.
Length of wing: 16.0 mm.
Width of head (at eyes): 1.80 mm.
Diameter of eye (long diameter): 0.307 mm.
Width of pronotum: 2.00 mm.
Width of wing (at widest point): 4.5 mm.

Although differing from the description, this may be Walker's *mexicanus;* Hagen states, however, that *mexicanus* is a synonym of *marginipennis* Latreille.

Soldier unknown.

Type locality.—Federal District of Mexico.

Type.—Described from a series of winged adults collected at the type locality by L. Conradt (No. 5), Hopk. U. S. No. 16533; winged adults have also been collected at Tacubaya, Mexico.

Type, winged adult.—Cat. No. 24563, U.S.N.M.

KALOTERMES TUBERCULIFRONS, new species.

Soldier (pl. 1, fig. 1).—Head castaneous, light yellow-brown posteriorly and darker—almost red-brown—on frontal slope, which is somewhat similar to the front of soldiers in Holmgren's subgenus *Glyptotermes*, that is, obliquely sloping, not being nearly vertical or sharply delimited as in the subgenus *Lobitermes* Holmgren. Nevertheless, this species (*K. tuberculifrons*) would probably be placed in the subgenus *Procryptotermes*[7] Holmgren, although the front of the head is not quite vertical. Front of head greatly depressed in center (not entire front), dark in depression. Head slightly broader in front, sides slightly concave. Eye spot large, pale except for dark rim, oblique, separated from the antennal socket by a distance equal to its short diameter. Large tubercle over each antennal socket. The long diameter of the tubercle is parallel to the rim of the antennal socket. Head with short hairs.

Mandibles black—lighter at base—shorter than width of head, broad and stout at base, slender and incurved at apex, but outer rims of mandibles not curved inwards as in *K. hubbardi* Banks; left mandible with two obliquely projecting pointed marginal teeth, not as near apex as in *K. hubbardi* Banks, broad tooth near base; right mandible with pointed marginal tooth near base, at basal third. Labrum yellow-brown, broader than long, with long hairs at tip, where broadly rounded.

Antennae pale, broken, pubescent; first, second, and third segments dark-castaneous, third segment greatly elongate, slender, clavate, longer than first and second segments together; fourth segment pale brown, ringlike, shorter than second segment.

Gula slender, hardly one third as broad in middle as at tip.

Pronotum light-castaneous, anterior margin black, apparently not as broad as head, twice as broad as long; anterior margin deeply roundedly emarginate and irregularly serrate (not dentate as in *hubbardi*). Lateral margins gradually slope posteriorly (nearly parallel); posterior margin almost straight.

Meso- and meta-notum and abdomen yellow-brown; abdomen with short pubescence.

---

[7] The subgenus *Procryptotermes* includes species from Madagascar. However, according to Holmgren, the winged adult is as in the genus *Cryptotermes* Banks, which is not true of North American species, which would fall into this subgenus if based on characters in the soldier caste alone; these characters are an enlarged and modified third segment of the antenna and the nearly vertical front of the head.

Legs pale, tibiae and tarsi darker, femora greatly swollen.

Measurements.

Total length of soldier (from tip of mandibles to end of abdomen): Approximately 10 mm.
Length of head with mandibles: 5.60 mm.
Length of head without mandibles and labrum: 3.70 mm.
Length of left mandible: 1.90 mm.
Length of pronotum: 1.90 mm.
Length of hind tibia: 1.70 mm.
Width of head (in front): 2.80 mm.

Close to *K. hubbardi* Banks, but constitutes a distinct species on account of its tuberculate front of head and other divergent characters.

Winged adult unknown; this soldier may belong to the winged adult *K. montanus* Snyder.

Type locality.—"Mexico."

Described from a single soldier in the collection of the United States National Museum labeled "Mexico."

Type, soldier.—Cat. No. 24564, U.S.N.M.

KALOTERMES CUBANUS, new species.

Soldier (pl. 1, fig. 2).—Head castaneous-brown, dark on anterior area (especially the front), paler on posterior area; twice as long as broad, about equally broad at anterior and posterior margins, lateral margins slightly concave. Postclypeus castaneous, broader than long, posterior margin convex. Labrum yellow-brown, broader than long, broadly rounded at apex, with long hairs. Head with scattered but fairly long, erect hairs on both dorsal and ventral surfaces. Eye spot much smaller and less deeply pigmented than in *Kalotermes jouteli* Banks, on a line with and close to antennal socket.

Mandibles black, stout, and very broad at base; left mandible with two pointed marginal teeth near tip, broader tooth nearer base; right manble with two broader and larger pointed teeth below those on left mandible. Tips of mandibles pointed and curved in.

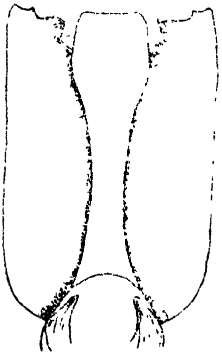


FIG. 1.—KALOTERMES CUBANUS. SOLDIER. VENTRAL VIEW OF HEAD, SHOWING GULA. GREATLY ENLARGED.

Antennae yellow-brown, first three segments castaneous; 17 segments, longer than mandibles, with long pubescence; third segment larger than second, or fourth, clavate, deeply colored; last segment short, slender, and subovate.

Gula much narrower in middle than in *jouteli*, the width at the middle being less than half the width at the front (fig. 1).

Pronotum yellow-brown, with dark anterior rim, not quite twice as broad as long in middle, broader than head, front roundly emarginate, broadest anteriorly, anterior margin high at corners; lateral margins rounded, gradually narrowing posteriorly; posterior margin nearly straight; pronotum with long hairs on margins.

Abdomen about same color as pronotum, ventral surface paler, with short, light-colored pubescence.

Legs paler in color; tibiae and tarsi darker, femora greatly swollen (fig. 2).

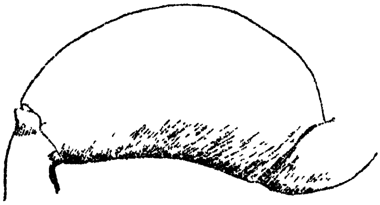


FIG. 2.—KALOTERMES CUBANUS. SOLDIER. HIND FEMUR. GREATLY ENLARGED.

Measurements.

Total length of soldier: 13.5 mm.
Length of head with mandibles: 5.75 mm.
Length of head without mandibles and labrum: 3.80 mm.
Length of left mandible: 1.90 mm.
Length of pronotum (not in middle but from anterior to posterior corners): 1.80 mm.
Length of hind tibia: 1.80 mm.
Width of head: 2.75 mm.
Width of pronotum: 3.00 mm.

Close to *Kalotermes jouteli* Banks of Florida and *K. mona* Banks of Mona Island, the Antilles, but with distinctive structural differences, a prominent character being the broad mandibles; in *mona* the third segment of the antenna is longer.

Type locality.—Las Playuelas, Pinar del Rio, Cuba.

Described from a large series of soldiers collected at the type locality by B. T. Barreto, No. 8616, January, 1921.

Type, soldier.—Cat. No. 24565, U.S.N.M.

Genus NEOTERMES Holmgren.

A genus closely related to the genus *Kalotermes* Hagen, widely distributed over the world. If based upon the soldier caste alone, *Neotermes* probably would only deserve rank as a subgenus. This is suggested from the soldier of *N. connexus* Snyder, which is intermediate between the two genera *Neotermes* and *Kalotermes*. However, the wing venation of the sexual adults of species of *Neotermes* renders it a valid genus.

In habits the various species of *Neotermes* are more forest inhabiting and they seem to be more dependent on moisture than in case of species of *Kalotermes;* apparently they are not as injurious to the woodwork of buildings as are species of *Kalotermes*.

NEOTERMES CONNEXUS, new species.

Winged adult.—Head dark castaneous-brown, anteriorly darker than posteriorly, not much longer than broad, rounded at base. Trace of frontal gland depression on line with posterior border of compound eyes. Head with scattered but long hairs on dorsum and margins. Compound eye not quite round, large, projecting, separated from lower (lateral) margin of head by a distance less than its diameter, scarcely two diameters from hind margin. Ocellus large, elongate, set obliquely to eye, almost touching it. Post-clypeus castaneous-brown, much broader than long. Labrum lighter colored than head, elongate, constricted toward apex, nearly truncate on tip, with long hairs.

Antennae yellow-brown, 17 to 19 segments; with long pubescence; first segment long, stout, subcylindrical; second shorter but elongate and clavate; third clavate, shorter than second, chitin more deeply colored; fourth more wedge-shaped, shorter than third; fifth longer; last segment slender, subovate.

Pronotum slightly paler than head, broader, anterior margin deeply concave; nearly twice as broad as long, shorter than wing stub or scale, rounded posteriorly and emarginate; margins with fairly dense long hairs.

Abdomen with dorsum about same color as pronotum, ventral surface paler; abdomen with long hairs.

Legs yellow-brown, tibiae darker.

Wing much longer than entire deälated adult, radial sector with 5–7 long branches to costa and several short branches; cubitus with 17 branches, not reaching apex (pl. 4, fig. 16).

Measurements.

Length of entire winged adult: 17.5 mm.
Length of entire deälated adult: 8.0 mm.
Length of head: 2.00 mm.
Length of pronotum: 1.30 mm.
Length of hind tibia: 1.50 mm.
Length of wing: 13.5 mm.
Width of head (at eyes): 1.80 mm.
Diameter of eye (long diameter): 0.405 mm.
Width of pronotum: 2.05 mm.
Width of wing: 4.0 mm.

The winged adult is allied to N. *castaneus* Burmeister.

Soldier.—Head shading in color from light yellow posteriorly to yellow-brown anteriorly and more castaneous at anterior margin; head longer than broad, lateral margins varying from short and rounded to longer and parallel, as is common in species of *Kalotermes.* Eye spot purplish, oblong, placed obliquely to side of head, separated from antennal socket by distance equal to its short diameter. Head with long scattered pubescence on the lateral margins.

Labrum yellow, not much broader than long, broadly rounded at apex (almost truncate), with long pubescence.

Mandibles black, castaneous-brown at base, base stout and broad, tip pointed; left mandible with two pointed marginal teeth near tip, a third lower rudimentary tooth and a broader "molar"; right mandible with one marginal pointed tooth at about the middle of mandible and another pointed tooth at base.

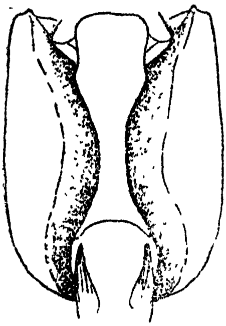


FIG. 3.—NEOTERMES CONNEXUS. SOLDIER. VENTRAL VIEW OF HEAD, SHOWING GULA. GREATLY ENLARGED.

Antennae yellow-brown, 15 segments, with long pubescence; first segment elongate, stout, cylindrical; second shorter, clavate; third castaneous-brown, clavate (slender at base), longer than second but not as long as fourth and fifth together, which are short and ringlike (slightly wedge-shaped); segments narrower toward apex; last segment slender and subovate.

Gula short and much narrowed in middle (fig. 3).

Pronotum yellow to yellow-brown, anterior margin deeply concave, posterior margin nearly convex but with slight emargination, not broader than head, much broader than long; pronotum with long hairs on lateral margins.

Abdomen dirty gray-white with tinge of yellow, with long hairs.

Legs with hind femora swollen (fig. 4), tibiae and tarsi darker.

Measurements.

Length of entire soldier: 10.5–11.7 mm.
Length of abdomen and thorax together: 5.25–6.75 mm.
Length of head with mandibles: 4.25–4.95 mm.
Length of head without mandibles: 3.10–3.20 mm.
Length of left mandible: 1.65–1.70 mm.
Length of pronotum: 1.25–1.45 mm.
Length of hind tibia: 1.35–1.40 mm.
Width of head: 2.35–2.45 mm.
Width of pronotum: 2.35–2.45 mm.

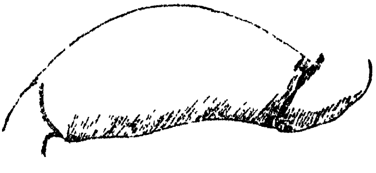


FIG. 4.—NEOTERMES CONNEXUS. SOLDIER. HIND FEMUR. GREATLY ENLARGED.

Soldier figured by D. T. Fullaway, but referred to *Neotermes castaneus* Burmeister.[8]

The series of soldiers upon which this description is based were found on the mountains of Oahu, Honolulu, Hawaii, Swezey collector, May 21, 1920, Hopk. U. S. No. 14199; soldiers with deälated adults.

Type locality.—Kauai, Territory of Hawaii.

---

[8] The Hawaiian Forester and Agriculturist, October, 1920, vol. 17, No. 10, p. 297, pl. 1, fig. 1.

Described from several winged and deälated adults, collected at type locality by B. P. Clark in March, altitude 915 meters (3,000 feet); winged adults were also collected at Olaa; soldiers with deälated adults were found on the mountains of Oahu, Honolulu, Territory of Hawaii.

Type, winged adult.—Cat. No. 24566, U.S.N.M.

This species, the "mountain form" of "*Calotermes*" of Hawaii, appears to be the "missing" or connecting link between the genera *Kalotermes* Hagen and *Neotermes* Holmgren, hence the specific name "*connexus.*" The adult is clearly a *Neotermes* due to its characteristic wing venation; the soldier, however, is a *Kalotermes* on account of its swollen femora and enlarged third segment of the antenna with the chitin deeply colored. Nevertheless, certain other known species of *Kalotermes* have the soldier with the third segment of the antennae simple, as *K. simplicicornis* Banks of Texas.

Biological notes.—A "mountain form"—a native Hawaiian termite—has long been known to exist.[9] This termite was referred to in literature as "*Calotermes castaneus* Burmeister." However, it is the above described *Neotermes connexus.* It is a true forest insect, confining itself entirely to the decaying or sometimes the living wood of trees; this termite is found only in the mountain forests, but occurs on all the islands.

This species of *Neotermes* with *Kalotermes immigrans*, formerly considered to be *marginipennis* Latreille, are widespread in Hawaii. While *Kalotermes immigrans* is considered to have been introduced to the islands (Bryan, 1915), *N. connexus* is endemic.

Winged adults of *N. connexus* have been collected at Kauai, elevation 915 meters (3,000 feet), in March, B. P. Clark, and at Olaa, elevation 800 meters (2,600 feet), in May, H. W. Henshaw. *K. immigrans* swarms in June, "June 30, 1918" (Fullaway).

References to biological or economic literature.

1915. BRYAN, W. A. Natural history of Hawaii. Honolulu, Hawaii, 1915, termites, p. 402. *Calotermes marginipennis* (introduced species); *C. marginipennis*, p. 425; *C. castaneus* (Hawaiian species), p. 425.

1920. FULLAWAY, D. T. Termites or white ants in Hawaii. The Hawaiian Forester and Agriculturist, vol. 17, No. 10, pp. 294-301, Oct.

NEOTERMES CONNEXUS, var. MAJOR, new variety.

Deälated adult.—Head dark castaneous-brown, somewhat darker anteriorly, shining; not much longer than broad, rounded at base, with scattered fairly long hairs. Compound eye not quite round, large, projecting, separated from lateral margin of head by a distance less than its diameter. Ocellus large, elongate, set obliquely and close to eye. Labrum yellow-brown, somewhat tongue shaped, broadest in middle, broadly rounded at tip—nearly truncate, with long hairs.

---

[9] R. McLachlan, Ann. Nat. Hist., ser. 5, vol. 12, 1883, p. 227; Perkins, F. H. 11 (2). p. 88.

Antenna yellow-brown, broken, with light yellow, long hairs; first segment long, stout, cylindrical; second shorter than first, more clavate; third somewhat darker colored, shorter than second, clavate; fourth short, about half as long as third, ringlike; fifth longer than fourth; antenna becomes gradually wider towards apex.

Pronotum slightly paler than head, broader, anterior corners turned down, anterior margins deeply concave, posterior margin plainly emarginate, nearly twice as broad as long, shorter than wing scale, long hairs on margins. Pronotum and wing scale longer than in *N. connexus* Snyder.

Abdomen with longer hairs than in *connexus.*

Legs with femora more enlarged than in *connexus.*

Measurements.

Length of entire deälated adult: 10.75–11.0 mm.
Length of head: 2.35–2.45 mm.
Length of pronotum: 1.30 mm.
Length of hind tibia: 1.70 mm.
Width of head (at eyes): 1.95–2.05 mm.
Diameter of eye: 0.408 mm.
Width of pronotum: 2.35+–2.45+ mm.

Soldier unknown.

More material is needed to determine whether this is merely a variety of *N. connexus* or a distinctive species. It is darker colored, larger, head and pronotum larger than in *connexus;* pronotum with posterior margin plainly emarginate; pronotum and wing scale with more numerous and longer hairs. The third segment of the antenna is longer and more clavate than in *N. connexus;* the last segment of the maxillary palpi is longer.

Type locality.—Kaiwiki, Hawaii, Territory of Hawaii.

Described from two deälated adults collected at the type locality by W. H. Ashmead in July; Acc. No. 38341. Kaiwiki is near Hilo—being a few miles above—at an elevation of 610 to 915 meters (2,000 to 3,000 feet).

Type, deälated adult.—Cat. No. 24675, U.S.N.M.

Genus CRYPTOTERMES Banks.

In 1906, Nathan Banks created the genus *Cryptotermes* for a termite from Florida, the soldier of which has a uniquely cavate head (*C. cavifrons*). Until recently this has been a genus of comparatively few known species. These are of local distribution, being apparently restricted to the Tropics or subtropical regions. There are several new species from the West Indies and South America.

In America there are six described species of *Cryptotermes: C.* "(*Calotermes*)" *brevis* Walker of Florida (Key West and Miami), Cuba, and Central and South America; *C. cavifrons* Banks of Florida; the very peculiar and characteristic *infumatus* Banks of Texas; and three species from Panama, all recently described by Banks (1919), namely: *brevicollis*, *dudleyi*, and *longicollis; longicollis* is described from the soldier caste alone.

According to Holmgren (1910), "*Calotermes*" *posticus* Hagen, from the West Indies, and "*Calotermes*" *solidus* Hagen, habitat unknown, also may belong to the genus *Cryptotermes*. Banks, however, considers *posticus* to be a *Kalotermes*.

Within both the genus and species there is considerable variation in the wing venation and size and shape of the antennal segments of the winged adult.

Species of *Cryptotermes* are very destructive to the interior woodwork of buildings and furniture. They are able to live in dry wood and penetrate wood directly. They do not live in the ground.

CRYPTOTERMES ROSPIGLIOSI, new species.

Winged adult.—Head castaneous, with a darker area between the eyes, lighter at front just behind post-clypeus. Head quadrangular, rather than elliptical, longer than broad, not as sharply narrowed at base as in *Cryptotermes brevis* Walker, few scattered short hairs. Tips of mandibles black. Labrum large, broadly rounded at front, with short pubescence on tip. Compound eye large, not quite round, nearly reaching to the antennal socket, separated from lateral margin of head by a distance less than its diameter; ocellus large (larger than in *C. brevis*), elongate, pointed at apex, at right angle to and close to the compound eye.

Antennae stout, longer than head, with 16 segments, slightly darker than the legs, pubescent, segments gradually become longer and wider toward apex; basal segment cylindrical, elongate; second clavate, elongate, longer than third, second and fourth subequal; third to fifth as broad as long; sixth slightly longer; seventh to ninth more elongate; from tenth on elongate and clavate; last segment narrower and oval.

Pronotum where broadest, near the base, slightly broader than head, approximately twice as broad as long. Anterior margin slightly concave, narrow, posterior margin nearly straight; lateral margins with fairly long hairs, longer than in *C. brevis*. A black dot anteriorly on each side. Pronotum rounded off more sharply at base than in *C. brevis*.

Abdomen, especially at end, with scattered but fairly long pubescence; ventral surface pale; cerci not prominent.

Legs, except tibiae, pale yellow, tibiae slightly darker.

Wing long; as usual, iridescent and hyaline, the costal veins yellowish-brown; wing not as broad as in *C. brevis* (pl. 5, fig. 20); in forewing the median is bent up to subcosta, beyond the middle of the wing (touching at about the fourth branch of the radial sector), radial sector with numerous branches to the costa (at least six). The cubitus runs out nearly straight toward tip of the wing (pl. 5, fig. 17).

Measurements.

Length of entire winged adult: 11.5–12 mm.
Length of entire deälated adult: 5+ mm.
Length of head: 1.45 mm.
Length of pronotum: 0.70 mm.
Length of hind tibia: 0.607 mm.
Length of anterior wing: 6.75 mm.
Width of head: 1.15 mm.
Diameter of eye: 0.207–0.300 mm.
Width of pronotum: ? (curled down).
Width of anterior wing: 2.10 mm.

Soldier caste unknown.

Close to *C. brevis*, but larger and lighter colored; the other specific characters are in head, thorax and wings. Type compared with a winged adult from Brazil, determined by Hagen, now in the collection of the Museum of Comparative Zoology, Cambridge, Massachusetts.

At the sugestion of Doctor Martini, this species is named in honor of Doctor Rospigliosi, Director of the Museum of Natural History of Lima, Peru.

Type locality.—Lima, Peru.

Described from three winged adults, collected at the type locality (near Lima, Peru) by Dr. Ezekiel A. Martini (No. 20), March 4, 1918. Hopk. U. S. No. 15278.

Type, winged male adult.—Cat. No. 24567, U.S.N.M.

CRYPTOTERMES PICEATUS, new species.

Winged adult.—Head castaneous-brown (piceous), darker colored than in *Cryptotermes brevis* Walker, quadrangular, longer than broad, rounded at base, lateral margins of head approximately parallel; few scattered hairs on surface—fairly long. Labrum large, broader than long, broadly rounded at apex with fairly long pubescence. Compound eyes large, nearly round, separated from the lower (lateral) margin of head by a distance less than their diameter, and distant from the posterior margin of head by a distance equal to over twice their diameter. Ocellus fairly large, almost touching compound eye, rounded.

Antennae paler colored than head, yellow-brown; 17? segments, broken; with fairly long pubescence; first segment long, stout, cylindrical; second clavate, slightly longer than the third which is nearly equal to the fourth; fifth also clavate, longer than fourth; last segment elongate, slender, subovate.

Pronotum slightly lighter colored than head, broader than head, approximately twice as broad as long, not as long as the wing scale. Pronotum deeply concave anteriorly, slightly convex posteriorly. Pronotum broader toward posterior margin; with long pubescence.

Wings with golden yellowish-brown costal veins; in forewing median is bent up to subcosta beyond middle of wing, touching at a point from the second to the fourth or fifth branch of the radial sector; radial sector with 7 branches to the costa; cubitus with numerous branches (14) and branched beyond middle of wing to margin before reaching apex (pl. 5, figs. 18 and 19).

Abdomen with same color as pronotum, paler on ventral surface; with scattered pubescence.

Legs paler in color than pronotum.

Measurements.

Length of entire winged adult: 11–12 mm.
Length of entire deälated adult: 4.5–5.0 mm.
Length of head: 1.20 mm.
Length of pronotum: 0.605 mm.
Length of hind tibia: 0.607 mm.
Length of wing: 9.5 mm.
Width of head: 1.05 mm.
Diameter of eye (long diameter): 0.207 mm.
Width of pronotum: 1.20+ mm. (slightly curled down).
Width of wing: 2.30 mm.

Soldier.—Very similar to the soldier of *C. brevis* Walker. The piceous black color of the anterior area of head and rugose areas extend posteriorly much further than in *brevis*. Anterior area of pronotum darker. Front of head more deeply emarginate and sunken. Eye spot present, but due to the darker color of the head, is not as distinct as in *brevis;* mandibles apparently not as long as in *brevis*.

Measurements.

Length of entire soldier: 4+ mm.
Length of head with mandibles (closed): 1.90 mm.
Length of head without mandibles: 1.70 mm.
Height of head (at anterior margin): 1.10 mm.
Length of pronotum (at corners): 0.80 mm.
Length of pronotum (in middle): 0.505 mm.
Length of hind tibia: 0.802 mm.
Width of head: 1.30 mm.
Width of pronotum: 1.30 mm.

Figured by D. T. Fullaway,[10] but referred to *Cryptotermes brevis* Walker.

---

[10] The Hawaiian Forester and Agriculturist, October, 1920, vol. 17, No. 10, p. 297, pl. 1, fig. 4.

The single soldier upon which this description is based was found at Honolulu, Oahu, Territory of Hawaii, D. T. Fullaway, collector, "3, 2, '19."

Type locality.—Honolulu, Oahu, Territory of Hawaii.

Described from several winged adults collected at the type locality by D. T. Fullaway, "10."

This termite is closely related to *C. brevis* Walker.

Type, winged adult.—Cat. No. 24568, U.S.N.M.

Biological notes.—According to Fullaway (1920), this species of *Cryptotermes* has been present in Hawaii at least since 1904. With *Coptotermes intrudens* Oshima it is responsible for the greater part of the destruction of the woodwork of buildings, furniture, and other timber. Both species are supposed to have been introduced into Hawaii and are at present confined principally to Honolulu, although spreading rapidly.

Records show that *Cryptotermes piceatus* swarms in May ("5/4/19," Fullaway). Flights occur from dusk on into the night and often occur after a rain (Fullaway, 1920).

References to biological or economic literature.

1919. CRAWFORD, D. L. Notes and Exhibitions. Proc. Hawaiian Ent. Soc., vol. 4, no. 1, June, p. 13. (*Coptotermes*, sp. destroying boxes in warehouses near water front. *Cryptotermes*, sp. destroying shooks in the bundle.)

1920. FULLAWAY, D. T. Notes and Exhibitions. Proc. Hawaiian Ent. Soc., vol. 4, no. 2, June, p. 249. (*Cryptotermes*, sp. small colony containing laying queen exhibited.)

1920. FULLAWAY, D. T. Termites or white ants in Hawaii. The Hawaiian Forester and Agriculturist, vol. 17, No. 10, pp. 294–301, Oct.

1921. FULLAWAY, D. T. *Cryptotermes brevis* in Hawaii (Isoptera). Proc. Hawaiian Ent. Soc., vól. 4, no. 3. Sept., pp. 456–457. (Known to have been in Hawaii previous to 1904.)

CRYPTOTERMES THOMPSONAE, new species.

Winged adult (pl. 2, fig. 4).—Head yellow-brown, head slightly darker than pronotum, lighter colored than *Cryptotermes brevis* Walker; head quadrangular, longer than broad, not as broad at base as at apex (longer and broader than in *C. brevis*); few scattered, fairly long hairs on head. Labrum light yellow, large, narrowed toward apex, where rounded, with fairly long pubescence. Compound eyes not circular, separated from the lower (lateral) margin of the head by a distance equal to less than the long diameter. Ocellus small, elongate, at oblique angle to compound eye, placed more obliquely to eye than in *C. dudleyi* Banks, distant less than its diameter from eye. Triangular, hyaline markings with a fairly large, pale, whitish, oblong, central spot anteriorly on head, in front of where fontanelle depression would be located.

Antennae yellow-brown, stouter than in *dudleyi*, 17 segments, pubescent; first segment long, stout, cylindrical; second short, clavate;

third longer, clavate, slender at base, chitin more deeply colored; fourth not quite as long as second and not much broader; fifth longer; last segment long and slender, sub-ovate; segments become broader toward apex.

Pronotum broader than head, lighter colored, pronotum not as long as the wing scale, lateral margins at base rounded more than in *brevis*, less parallel, longer and wider than in *brevis*. Pronotum widest at apex; in *brevis* widest in center.

Wings with costal veins golden yellowish-brown, not as broad as in *brevis;* in the forewing the median vein is bent up to the subcosta beyond the middle of the wing touching at approximately the second branch of the radial sector; radial sector with 5 branches to the costa; cubitus with numerous branches (12), branched to apex slightly beyond middle.

Abdomen same color as pronotum, paler on ventral surface, with scattered but fairly long pubescence, less stout than in *dudleyi*.

Legs paler than pronotum, tibiae somewhat darker.

Measurements.

Length of entire winged adult: 9.75-10 mm.
Length of entire dealated adult: 4.5–6 mm.
Length of head: 1.80 mm.
Length of pronotum: 0.70 mm.
Length of hind tibia: 0.807 mm.
Length of anterior wing: 6.50 mm.
Width of head (at eyes): 1.00 mm.
Diameter of eye (long diameter): 0.300 mm.
Width of pronotum: ? (curled down)
Width of anterior wing: 1.90 mm.

Soldier (pl. 2, figs. 5 to 9).—Front of head and mandibles black (mandibles with reddish tinge), remainder of head shading respectively from reddish, anteriorly, to light yellowish-brown, posteriorly. Head elongate, not tuberculate as in *C. brevis* Walker although edge of ridge is roughened; head and mandibles longer than in *brevis*. Scattered, erect hairs on surface of head. Small, oblique, oval eye spot back of antenna plainly visible.

Antenna very pale except first 3 segments which have the chitin colored; 13 segments, pubescent; first segment elongate, cylindrical; second clavate, shorter than first; third shorter than second, narrower, clavate; fourth broader than third but shorter; segments increase in width to last segment which is slender, elongate, oval.

Mandibles visible from above, with marginal teeth; mandibles more slender than in *brevis*.

Pronotum dark in front, broader than long but not nearly twice as broad as long; deeply angularly emarginate anteriorly, borders coarsely serrate in front, long hairs on sides, short erect hairs on surface; pronotum longer and more deeply cleft than in *C. brevis*. Sides broadly rounded posteriorly, hind margin slightly emarginate.

Measurements.

Length of entire soldier: 5–6 mm.
Length of head with mandibles: 2.15–2.40 mm.
Length of head without mandibles: 1.20–1.40 mm.
Length of left mandible: 0.95–1.0 mm.
Height of head: 1.20 mm.
Length of pronotum (at corners): 0.80–0.90 mm.
Length of hind tibia: 0.807 mm.
Width of head: 1.35–1.40 mm.
Width of pronotum: 1.35–1.40 mm.

The series of soldiers upon which this description is based were found at Ancon, Canal Zone, Panama, J. Zetek and I. Molino, collectors, "6/21/21," from dry oak baseboard of revolving bookcase, Acc. No. Z. 1498; it was not found with the type of the winged adult, but with metatypes—deälated, sexual adults.

Fritz Müller[11] writes:

> *Calotermes smeathmani* und *C. hagenii* unterscheiden sich von anderen bekannten arten dadurch, dass bei den Soldaten der aufgebogene Vorderrand des Prothorax gezähnelt ist. Auch die Kopfbildung der Soldaten ist eine sehr eigenthümliche. Bei den Soldaten von *C. smeathmani* finden sich Flügelscheiden an Mittel- und Hinterbrust, die bei denen des *C. hagenii*, wie bei denen unserer anderon *Calotermes*—Arten fehlen.

Holmgren (1910) founded his new subgenus *Eucryptotermes* on the single species *hageni* of Fritz Müller; it is a South American invalid species, apparently closely related to *Cryptotermes thompsonae* Snyder.

Silvestri[12] states:

> È probabile che una delle due specie date da Fritz Müller (Jen. Zeit. VIII, p. 341, nota 3) con il nome di *Calotermes smeathmani* e *C. hagenii* sia uguale al mio *C. taurocephalus* e l'altra al *C. triceromegas*, però le descrizioni che abbiamo sono tanto brevi, che non permettono assolutamente fare con sicurezza tali identificazioni.

C. triceromegas Silvestri appears to be a *Cryptotermes* and is closely related to *thompsonae*.

The deeply serrate front margin of the pronotum of the soldier is a striking character in *thompsonae*.

This species is named in honor of Dr. Caroline Burling Thompson, Professor of Zoology at Wellesley College, Wellesley, Mass., in recognition of her valuable work on the morphology of termites.

Type locality.—Ancon, Canal Zone, Panama.

Described from a series of winged and deälated adults, collected at the type locality by H. F. Dietz, "V–7," "9–11–16, 1919"; Dietz Acc. No. G. 541, Hopk. U. S. No. 14174; collected flying at night in room in Hotel Tivoli.

Type, winged adult.—Cat. No. 24569, U.S.N.M.

---

[11] Jenaische Zeitschrift für Medizin und Naturwissenshaft, vol. 7, 1871–1873, p. 341, note 3.

[12] Redia, vol. 1, 1903, p. 26.

Genus COPTOTERMES Wasmann.

Some of the most destructive species of termites in the world to the woodwork of buildings and other timber belong to this genus. *Coptotermes formosanus* Shiraki is capable of dissolving lime mortar by secretions from the tubular frontal gland, according to Oshima.

Species in the genus *Coptotermes* are widely distributed throughout the world, but the genus is apparently not rich in species.

Fortunately, no species occurs in the United States.

The soldier caste is distinctive, having a short tubular projection on the front of the head, that is, the opening of the frontal gland.

COPTOTERMES NIGER, new species.

Winged adult.—Head very dark, castaneous-brown to black. Head elliptical but longer than broad, broadest at eyes, with long pubescence. Fontanelle a round depression between compound eyes. Eyes nearly round, distant less than their diameter from lower margin of head, about an eye diameter from front of head, slightly projecting. Ocellus its long diameter distant from eye, placed obliquely to eye. Post-clypeus yellow-brown, much broader than long. Labrum yellow-brown, elongate, somewhat tongue-shaped, longer than broad—broad at base—rounded at tip; with long golden-yellow pubescence.

Antennae light brown, longer than head, 21 segments, pubescent; first segment long, stout, cylindrical; second approximately half the length of first; third short; fourth rounded, longer, but not as long as second, becoming stouter towards apex; last segment long, slender, subovate.

Pronotum same color as head, nearly twice as broad as long, not broader than head, subcordate; both anterior and posterior margins slightly emarginate but anterior margin more concave, posterior margin nearly straight, lateral margins with long pubescence.

Wing scale slightly longer than pronotum; with long pubescence; wings dark gray-brown, ciliate, 12 mm. in length; short pubescence on surface of wings. Median nearer to cubitus, normally with 2 branches at apex; cubitus with 17 branches, or subbranches (pl. 5, fig. 21).

Dorsal surface of abdomen same dark color as head and pronotum, with long pubescence; ventral surface of body yellow-brown, with long golden-yellow pubescence.

Legs yellow-brown.

Measurements.

Length of entire winged adult: 13–13.5 mm.
Length of entire dealated adult: 6.5–7.0 mm.
Length of head: 1.60–1.65 mm.
Length of pronotum (at corners): 0.90 mm.
Length of hind tibia: 1.30 mm.

Length of anterior wing: 10.5–11.5 mm.
Length of wing scale: 1.0 mm.
Diameter of eye: 0.300–0.307 mm.
Width of head: 1.30–1.40 mm.
Width of pronotum: 1.30–1.40 mm.
Width of anterior wing: 3.00–3.25 mm.

Winged adult darker and smaller than that of *Coptotermes marabitanus* Hagen: compared with the type of the latter in the Museum of Comparative Zoology, Cambridge, Massachusetts.

Soldier.—Head yellow-brown, slightly darker on anterior portion; shorter than in *marabitanus;* broadest posteriorly back of longest hairs or bristles on margin of head; tapers toward anterior area more sharply than in *marabitanus*, more pointed at apex (fig. 5); with light yellow, long, scattered hairs on dorsum and lateral margins, also on ventral surface from anterior to posterior areas. Gula slightly broader and shorter than in *marabitanus* but not as broad as in *crassus* Snyder; breadth in middle about half that at anterior area (fig. 5). Mandibles castaneous-brown to black, curved at tip, long, more slender than in either *marabitanus* or *crassus*. Left mandible with marginal teeth at base less prominent than in *crassus*.

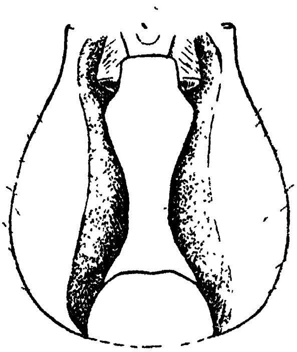


FIG. 5.—COPTOTERMES NIGER. SOLDIER. VENTRAL VIEW OF HEAD SHOWING GULA. GREATLY ENLARGED.

Labrum castaneous-brown, elongate, subtriangular, less sharply pointed than in *crassus*, slightly constricted at tip, two long hairs on tip.

Antennae light yellow-brown, 14 segments, pubescent; first segment long, cylindrical, stout; second shorter, but longer than third or fourth; fifth approximately equal to second; last segment short, slender, subovate.

Pronotum light yellowish, not as long as in *crassus* or even in *marabitanus*, with long hairs.

Abdomen dirty white with tinge of yellow, with long pubescence.

Legs light yellow, elongate, slender.

Measurements.

Length of entire soldier: 4–4.50 mm.
Length of head with mandibles: 2.0–2.1 mm.
Length of head without mandibles: 1.20–1.30 mm.
Length of left mandible: 0.80–0.85 mm.
Length of pronotum: 0.40 mm.
Length of hind tibia: 0.800–0.902 mm.
Width of head (at widest point): 1.15–1.20 mm.
Width of pronotum: 0.702–0.750 mm.

The large series of soldiers upon which this description is based were found at Gamboa, Canal Zone, Panama, H. F. Dietz, collector, "V, 14, 1919," Dietz Acc. No. G. 550, Hopk. U. S. No. 14174h—"in old post"; they were not found with the typical winged adult but are probably the same species, since winged adults of only one species of *Coptotermes* have been so far collected at Panama.

Type locality.—Juan Mina, Canal Zone, Panama.

Described from a large series of winged adults collected at the type locality by H. F. Dietz, "V, 14, 1919," Dietz Acc. No. G. 546, Hopk. U. S. No. 14174c; specimens of winged adults were also collected at Panama City, Panama, and Ancon, Canal Zone.

Type, winged male adult.—Cat. No. 24570, U.S.N.M.

COPTOTERMES CRASSUS, new species.

Soldier.—Head yellow-brown, slightly darker on anterior portion; head longer and stouter than in *Coptotermes marabitanus* Hagen; broadest at longest bristles or hairs on lateral margins near posterior margin—about half way between antennal socket and posterior margin of head; not twice as broad as pronotum; tapers anteriorly (fig. 6); scattered pubescence (long) on dorsal surface and lateral margins. Eye spot visible. Gula broader (wider in middle) than in *C. marabitanus;* more than half as broad at middle than at anterior margin (fig. 6). Mandibles black, long, slender, curved at tip, light colored at base; broader at base than in *marabitanus* or *niger* Snyder; four rudimentary marginal teeth at base of left mandible as in *marabitanus*. Labrum castaneous-brown, longer than broad, not as long as in *marabitanus*, broader at base; elongate subtriangular, tip constricted, with two long hairs.

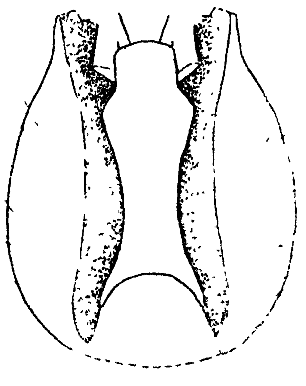


FIG. 6.—COPTOTERMES CRASSUS. SOLDIER. VENTRAL VIEW OF HEAD, SHOWING GULA. GREATLY ENLARGED.

Antennae light yellow-brown, extend beyond mandibles, 14–15 segments, less slender than in *marabitanus*, light colored pubescence on antennae; first segment elongate, stout, subclavate; second short; third shorter than second or fourth; last segment short, slender and subovate.

Palpi same color as antennae, elongate, slender, more slender than in *niger*.

Pronotum light yellowish, twice as broad as long, larger than in *marabitanus;* long pubescence on lateral margins and on surface.

Abdomen dirty white with tinge of yellow, with long pubescence.

Legs yellow, stouter than in *marabitanus*.

Soldier shorter and stouter—more robust than in *marabitanus;* compared with the type of *marabitanus* in the Museum of Comparative Zoology, Cambridge, Massachusetts.

Measurements.

Length of entire soldier: 5–6 mm.
Length of head with mandibles: 2.20–2.45 mm.
Length of head without mandibles: 1.40–1.50 mm.
Length of left mandible: 0.90–0.95 mm.
Length of pronotum: 0.305–0.406 mm.
Length of hind tibia: 1–1.005 mm.
Width of head (at widest point): 1.102–1.35 mm.
Width of pronotum: 0.805–0.95 mm.

Type locality.—San Juan Pueblo, Spanish Honduras, which is in the hills north and inland from Ceiba, which is on the coast.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, Bureau of Entomology, U. S. Department of Agriculture, February–March, 1920; soldiers were also found at Lombardia and Ceiba, Spanish Honduras.

Type, soldier.—Cat. No. 24571, U.S.N.M.

Genus ARMITERMES Wasmann.

In this interesting genus the soldier caste is an intermediate between the mandibulate soldier and the "nasutus" or soldier with a nasus or beak, since soldiers of species of *Armitermes* have both mandibles and a nasus. The relative lengths of the mandibles and nasus vary with the species and are of taxonomic value. *A. intermedius* Snyder has mandibles and nasus of approximately equal length, hence the specific name. In front view, the head of the soldier reminds one of the head of an elephant.

The nasus is an organ of defense as well as the mandibles and is probably a more effective weapon in nasuti than the mandibles in the mandibulate soldiers; a sticky substance is exuded which "gums up" ants and other enemies.

There is a remarkable progressive development of the frontal gland from *Reticulitermes* Holmgren, where it is merely a circular opening ("retrocerebral" gland) up through *Mirotermes* Wasmann, *Coptotermes* Wasmann, *Cornitermes* Wasmann, *Armitermes* Wasmann, to *Nasutitermes* Banks and *Constrictotermes* Holmgren, where the mandibles are rudimentary and the nasus long and well developed. Even in the Kalotermitidae or lower termites there is a slight trace of the frontal gland.

The "nasute" soldier is merely a more highly specialized mandibulate soldier and a much more useful member of the colony—a mutant or "segregant" worth while.

In *Rhinotermes* Hagen the minor soldier, the "gabel nasutus" of authors, has the labrum extended into a slender tube, forked at the tip. In *Armitermes intermedius* the tip of the labrum is hollow and tubular.

ARMITERMES INTERMEDIUS, new species.

Soldier (pl. 1, fig. 3).—Head yellowish-brown, nasus slightly darker on sides; head much broader but shorter than in *A. heterotypus* Silvestri, longer than broad, somewhat retort shaped in lateral view; broadest at base, tapers anteriorly, rounded at base; few long hairs or bristles on anterior and posterior margins of head. Gula elongate, slender, tapering anteriorly, lateral margins dark castaneous-brown. Nasus slightly shorter than width of head at anterior margin where head is least broad; nasus broadest at base tapering to apex, slightly emarginated at tip; end of nasus directly over tip of labrum (in lateral view); short hairs on apex of nasus.

Mandibles dark castaneous-brown to black except at base where yellow-brown; mandibles when closed extending beyond tip of nasus. Mandibles curved, broad at base, slender at apex; marginal tooth near middle, with its outer edge near the inner margin of mandible and distinctly parallel to margin of mandible; inner edge of marginal tooth forming a sharp angle with the mandible.

Labrum broadest at base, yellow-brown, tapering to apex, where it is membranous, white and looks like a hollow, white, fleshy tube; covered with long golden-yellow pubescence.

Antennae yellow-brown, longer than head, slender, 15–16 segments, with long pubescence; first segment long, stout, cylindrical; second shorter, more slender, subclavate; third clavate, slightly longer than second; fourth and fifth subequal and approximately equal in length to third, or slightly longer than third; sixth longer; antennae becoming more clavate-shaped and slender at seventh segment; last segment subovate and slender.

Pronotum yellow-brown on posterior margins; saddle-shaped; broadest at middle, nearly twice as broad as long; rounded at apex, posterior half trapezoidal, long pubescence on lateral margins.

Abdomen gray with tinge of yellow, with long, golden-yellow pubescence.

Legs yellowish, long and slender.

Measurements.

Length of entire soldier: 5.75–7.25 mm.
Length of head with mandibles: 3.1–3.35 mm.
Length of head without mandibles (to base labrum): 2.15–2.30 mm.
Length of left mandible: 1.25–1.35 mm.
Length of head with nasus: 2.75–2.95 mm.
Length of nasus: 0.95–1.2 mm.
Length of abdomen and thorax together: 4.0–4.85 mm.
Length of pronotum: 0.50–0.60 mm.
Length of hind tibia: 1.80–2.00 mm.
Width of head (at widest point): 1.90–2.15 mm.
Width of pronotum: 1.15-1.20 mm.

Worker.—Head yellowish-white, longitudinal grayish markings, not much longer than broad, broadest anteriorly, rounded posteriorly; post-clypeus bulging, twice as broad as long. Antennae yellowish-brown at apex, 15 segments; first segment long, stout and cylindrical; second shorter, more slender; third slightly longer than second.

Pronotum saddle-shaped, yellowish.

Abdomen gray.

Legs yellowish, long, slender.

Measurements.

Length of entire worker: 5.0–5.75 mm.
Length of abdomen and thorax together: 3.80–4.10 mm.
Length of head: 1.65–1.75 mm.
Length of hind tibia: 1.25–1.30 mm.
Width of head: 1.40–1.50 mm.

Described from a series of workers found with the typical soldier.

A striking species of *Armitermes;* the wide head of the soldier, short nasus and position of the marginal tooth are very distinctive.

Type locality.—Ceiba, Spanish Honduras.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, of the Bureau of Entomology, U. S. Department of Agriculture; in rotten log, February–March, 1920; soldiers and workers were also found at Lombardia, Spanish Honduras.

Type, soldier.—Cat. No. 24572, U.S.N.M.

Genus CONSTRICTOTERMES Holmgren.

In 1910, Holmgren divided the genus *Eutermes* Fritz Müller into many subgenera; however, certain American species do not readily fall into these subgenera. In 1920, Banks adopted the name *Nasutitermes* for one *Eutermes* form and raised the subgenus *Constrictotermes* Holmgren to generic rank.

In general, the different species of the genus *Constrictotermes* (as used in a broad sense by Banks) are similar to those of the genus *Nasutitermes;* however, the head of the soldier or nasutus is always constricted. Nevertheless, the species *diversimilis* Silvestri, from South America, has three different types of soldiers and has been placed in the subgenus *Diversitermes* Holmgren. Yet, if the contour of the head alone were considered, the "large" soldier or nasutus would fall in the genus *Nasutitermes*, whereas the "middle" and "small" soldiers would be placed in the genus *Constrictotermes*. However, there are other striking characters in the nasute caste, namely, the length of the legs, the number of hairs on the head, etc., which vary considerably in the different subgenera. In the worker caste the relative length and width of the post-clypeus is of subgeneric value. Most of the described species are from America. In comparison with the many species in the genus *Nasutitermes*, this genus may be considered as composed of but few species.

Except for the fact that the nasuti have few hairs on the head, whereas there are quite a number of hairs or bristles on the heads of the soldiers of species of *Tenuirostritermes*, the two species of *Constrictotermes* to be described in this paper, namely, *incisus* and *briciae*, would fall into Holmgren's subgenus *Tenuirostritermes*. This subgenus has only one type of nasutus and it has shorter legs than in the subgenus *Velocitermes* Holmgren. Furthermore, the species do not construct semispherical, carton, "niggerhead" tree nests. In *Tenuirostritermes* the post-clypeus of the worker is about as long as half its breadth (twice as broad as long).

The subgenus *Velocitermes* includes species which have two types of nasuti or soldiers, with few hairs on the head and with long legs; the mandibles are somewhat longer than in soldiers of species of *Tenuirostritermes*. Species of *Velocitermes* do not construct carton tree nests.

In the subgenus *Constrictotermes* Holmgren (restricted sense), the species have only one type of nasutus, with peculiarly constricted head and with many hairs on the head. Species are included in this genus which do construct carton tree nests.

C. incisus and *briciae* have only one type of nasutus, so far as known (only one has been collected). There are but few hairs on the head: the mandibles are extremely short (much shorter than in species of *Tenuirostritermes*); the legs of the soldier are as long as in species of *Tenuirostritermes*. In the worker the post-clypeus is about twice as broad as long. Neither of these new species were found in carton tree nests. Hence. I place them in the subgenus *Tenuirostritermes*.

CONSTRICTOTERMES (TENUIROSTRITERMES) INCISUS, new species.

Soldier (pl. 3. figs. 10 and 11).—Head dark castaneous-brown, almost black, with a lighter brown color on base of head around the base of the antennae and at the tip of nasus. Ventral portion of head also lighter colored. Head deeply constricted (angles acute), with basal portion approximately one and one-half times as long as apical portion (without the nasus)—basal portion longer than the nasus, also broader than the apical portion; head rounded posteriorly, basal portion of head dorsally with one long bristle on each side where head is widest. Nasus same color as head, long and slender; pointed at apex where lighter colored and with short pubescence. The head forms an angle with prothorax.

Antennae yellowish-brown. 13 segments, with long pubescence; first segment elongate, stout and cylindrical; second short. approximately half the length of first. clavate; third long and tapering, clavate, slender at base, nearly as long as first; fourth approximately equal to second; fifth longer than fourth but not as long as third; last segment long, slender and subovate.

Pronotum yellow-brown, saddle-shaped, wider than long (narrow), with short hairs on anterior margin, posterior margin emarginate. Meso- and meta-notum and dorsum of abdomen yellow-brown. Abdomen with long, golden-yellow pubescence, ventral surface paler.

Legs yellow-brown, long and slender.

Measurements.

Length of entire soldier or nasutus: 2.75-3 mm.
Length of head with nasus: 1.20-1.45 mm.
Length of head without nasus (to anterior of head): 0.90–1.00 mm.
Length of nasus: 0 405–0.50 mm.
Length of abdomen and thorax together: 1.75–2.00 mm
Length of pronotum: 0.105 mm.
Length of hind tibia: 0.900–.906 mm.
Width of head (at widest point): 0.50-0.505 mm.
Width of pronotum: 0 307 mm.

Worker.—Head castaneous-brown, lighter at base of antennae, broadest anteriorly, longer than wide, tapers where rounded posteriorly, with short pubescence. Post-clypeus yellow-brown, about twice as broad as long, projecting (raised). Labrum yellowish, broadest at middle, rounded at apex, tapers posteriorly, pubescent on anterior area.

Antennae yellow, longer than head, 13–14 segments, with long pubescence; first segment long, stout, cylindrical; second clavate, short, half length of first; third longer than second, clavate, slender at base, not as long as first; fourth clavate, short, approximately as long as second; fifth clavate, longer; last segment long, slender, subovate.

Pronotum lighter colored than head, saddle-shaped, broader than long (narrow), with short pubescence on anterior and lateral margins.

Meso- and meta-notum and dorsum of abdomen same color as pronotum.

Ventral surface of abdomen lighter colored, with long, golden-yellow pubescence.

Legs yellow, long, with pubescence.

Measurements.

Length of entire worker: 3.60–4.00 mm.
Length of abdomen and thorax together: 2.75–3.00 mm.
Length of head: 1.40–1.50 mm.
Length of hind tibia: 1.10 mm.
Width of head: 1.10 mm.

Described from a series of workers found with the typical soldier.

Type locality.—San Pedro, Spanish Honduras. San Pedro is inland, the terminus of the railroad from Puerto Cortes.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, Bureau of Entomology, U. S. Department of Agriculture, February–March, 1920.

Type, soldier.—Cat. No. 24575, U.S.N.M.

CONSTRICTOTERMES (TENUIROSTRITERMES) BRICIAE, new species.

Soldier (pl. 3, figs. 12 and 13).—Head light castaneous-brown, nasus darker, except at tip, the heads of some soldiers (immature?) straw colored; deeply constricted. head and nasus similar in shape to *Constrictotermes incisus* Snyder, but head and body longer, broader, and thicker: head broadest at base, at angle to thorax. Hairs and bristles on head as in *C. incisus.* Ventral portion of head slightly lighter colored.

Antennae yellow-brown, 13 segments, pubescent; first segment long, cylindrical, stout; second short, more slender, cylindrical, less than half the length of the first; third clavate, long, slender, tapering at the base, twice the length of the second; fourth equals second; fifth shorter than third; last segment long, slender, subovate.

Pronotum light yellow-brown, saddle-shaped, wider than long, longer than in *incisus*, short pubescence on anterior area and few long bristles on anterior and lateral margins.

Meso- and meta-notum same color as pronotum, longer than in *incisus.*

Dorsum of abdomen slightly darker (grayish): ventral surface lighter colored; abdomen with long golden-yellow pubescence.

Legs yellowish, long and slender.

Measurements.

Length of entire soldier: 3.25-3.85 mm.
Length of head and nasus: 1.40–1.50 mm.
Length of head without nasus: 0.75–1.0 mm.
Length of nasus: 0.450–0.50 mm.
Length of abdomen and thorax together: 2.10–2.70 mm.
Length of pronotum: 0.105–0.107 mm.
Length of hind tibia: 0.808–1.10 mm.
Width of head: 0.602–0.605 mm.
Width of pronotum: 0.400–0.430 mm.

Worker.—Head light castaneous-brown, broadest at base of antennae, tapers posteriorly where rounded, longer than broad; with short pubescence. Post-clypeus yellow, about twice as broad as long, projecting. Labrum yellowish, broadest at middle, approximately same shape as in *incisus*, pubescent on anterior area.

Antennae yellow to yellow-brown, longer than head, 14 segments, with long pubescence; first segment long, stout, cylindrical; second, short, more slender, clavate; third, long, slender, narrow at base, clavate, twice the length of the second; fourth, shorter, clavate; fifth, longer; last segment, slender, long, subovate.

Pronotum lighter than head, saddle-shaped, broader than long, with some long bristles and short pubescence on surface and margins.

Meso- and meta-notum same color as pronotum.

Dorsum of abdomen slightly darker, grayish brown, ventral surface lighter; abdomen with long golden-yellow pubescence.

Legs yellow, long, pubescent.

Measurements.

Length of entire worker: 4.25–4.60 mm.
Length of abdomen and thorax together: 3.25–3.40 mm.
Length of head: 1.4–1.5 mm.
Length of hind tibia: 1.0–1.10 mm.
Width of head: 1.10–1.20 mm.

Described from a series of workers found with the typical soldier.

A lighter colored, larger, longer, and broader species than *C. incisus*, shape of head equally strikingly perconstricted or deeply incised.

Named in honor and memory of my mother, née Alice Celinda Brice.

Type locality.—Lombardia, Spanish Honduras. Lombardia is north and inland from Ceiba, which is on the coast.

Described from a series of soldiers collected at the type locality by Dr. W. M. Mann, Bureau of Entomology, U. S. Department of Agriculture, February-March, 1920.

Type, soldier.—Cat. No. 24576, U.S.N.M.

Genus ANOPLOTERMES Fritz Müller.

Species of this genus have no soldier caste. But few species are known and most of these are from America. Certain species in the Tropics build large mounds.

The worker caste is usually of a dirty gray color, and workers have the habit of moving about in files or lines.

ANOPLOTERMES GRACILIS, new species.

Winged adult.—Head dark brown, not as broad as in *A. ater* Hagen, broadest at the eye, broader than pronotum, rounded posteriorly, densely pubescent, hairs long and golden-yellow; head longer than broad; fontanelle indistinct. Post-clypeus yellow-brown, over twice as broad as long, projecting, pubescent; in *ater* fully three times as broad as long and not at all bulging out or projecting. Labrum yellow, elongate, subtriangular, rounded at tip, pubescent, extends to tip of mandibles; mandibles not as long as in *A. fumosus*

Hagen. (*A. ater* has the mandibles fairly long, but also not as long as in *fumosus.*) Eyes black, large, nearly round, not as projecting as in *ater*, very near lower margin of head, separated from both anterior or posterior margin of head by a distance less than an eye diameter. Ocellus large, elongate, deeply inset (with projecting upper rim), separated from the compound eye by a distance less than its short diameter, set obliquely to eye.

Antennae yellow-brown, slender, 15 segments, pubescent; first segment long, stout, cylindrical; second shorter, subclavate; third very short; fourth longer but shorter than second; last segment slender, subovate.

Pronotum yellow-brown, somewhat broader than long, not broader than head, broadest at anterior margin, anterior and posterior margins straight, lateral margins angularly, posteriorly sloping, dark brown markings on anterior area, long pubescence on lateral margins.

Meso- and meta-notum dark brown, with long pubescence, emarginate on posterior margins.

Wing dark, ciliate on margin, 8.5 mm. long, median usually branching at apex, 0 to 3 branches, cubitus (submedian) with 9–11 branches, median nearer to cubitus than to costal veins (pl. 5, fig. 22).

Abdomen with tergites dark brown, with dense, short and long, golden-yellow pubescence, less broad than in *ater*, not so stout.

Legs yellow-brown, slender, fairly elongate.

Measurements.

Length of entire winged adult: 9.5–11 mm.
Length of entire deälated adult: 5.5–6.5 mm.
Length of head (to tip labrum): 0.90–1.0 mm.
Length of pronotum: 0.402–0.500 mm.
Length of hind tibia: 0.800 mm.
Length of anterior wing: 10.5 mm.
Length of wing scale: 0.500 mm.
Width of head (at eyes): 0.65–0.75 mm.
Diameter of eye: 0.202–0.207 mm.
Width of pronotum: 0.65+mm. (curled down).
Width of anterior wing: 2.65 mm.

A lighter colored, shorter species than *A. ater.*

Type locality.—Ancon, Canal Zone, Panama.

Described from a large series of winged adults, collected at the type locality by H. F. Dietz, April 19, 1919, in outer wall of wasps' nest on royal palm tree; Dietz Acc. No. G. 475*a*, Hopk. U. S. No. 14124h; winged adults were also collected at Panama City, Panama, by H. F. Dietz and I. Molino, on April 19, 1919, at lights in houses.

Type, winged male adult.—Cat. No. 24573, U.S.N.M.

ANOPLOTERMES MANNI, new species.

Worker.—Head and thorax white with tinge of yellow. Head longer than broad, broadest where antennae are attached and tapers from here to posterior margin of head which is rounded; with long pubescence. Post-clypeus projecting, not twice as broad as long; labrum elongate, subtriangular, rounded at tip, with long pubescence.

Antennae white, but somewhat yellowish and widening out toward apex; 14 segments, pubescent; first segment, elongate, stout, cylindrical; second short, not much narrower than first; third and fourth approximately subequal, ring-like and short, last segment longest and subovate.

Pronotum saddle-shaped, with long pubescence.

Abdomen fusiform, dirty gray in color, with long light colored pubescence.

Legs white with tinge of yellow; tibiae of front legs markedly swollen, as is usual in species of this genus.

Measurements.

Length of entire worker: 2.65–3.25 mm.
Length of abdomen and thorax together: 2.0–2.5 mm.
Length of head: 0.65–0.70 mm.
Length of hind tibia: 0.303–0.307 mm.
Width of head: 0.402–0.405 mm.

A small but elongate and slender worker. Named in honor of Dr. W. M. Mann, of the Bureau of Entomology, United States Department of Agriculture, who has collected many species of termites in the Tropics. It is unusual to base a species on a worker, but this worker seems to be quite distinct, and a name is desirable to assign the termitophiles which were found with this species.

Type locality.—Lombardia, Spanish Honduras. Lombardia is north and inland from Ceiba, which is on the coast.

Described from a series of workers, collected at the type locality by Dr. W. M. Mann, February-March, 1920, beneath deeply embedded stone, termitophiles present.

Type, worker.—Cat. No. 24574, U.S.N.M.

EXPLANATION OF PLATES.

Drawings made by Miss Eleanor T. Armstrong, of the Bureau of Entomology.

PLATE 1.

New Species of Kalotermes and Armitermes.

FIG. 1. ***Kalotermes tuberculifrons*** Snyder. Soldier. Dorsal view of head and pronotum showing tubercles on front of head. (Enlarged approx. 12 X.)

2. ***Kalotermes cubanus*** Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 12 X.)

3. ***Armitermes intermedius*** Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 15 X.)

PLATE 2.

A new Cryptotermes with front of pronotum serrate in soldier caste.

FIG. 4. ***Cryptotermes thompsonae*** Snyder. Winged adult. Dorsal view of head, showing hyaline markings on head. (Enlarged approx. 30 X.)

5. ***Cryptotermes thompsonae*** Snyder. Soldier. Lateral view of head and pronotum. (Note serrate front of pronotum.) (Enlarged approx. 25 X.)

6. ***Cryptotermes thompsonae*** Snyder. Soldier. Three quarters view of head and pronotum. (Enlarged approx. 25 X.)

7. ***Cryptotermes thompsonae*** Snyder. Soldier. Dorsal view of pronotum. (Enlarged approx. 25 X.)

8. ***Cryptotermes thompsonae*** Snyder. Soldier. Dorsal view of left mandible, showing marginal teeth. (Enlarged approx. 30 X.)

9. ***Cryptotermes thompsonae*** Snyder. Soldier. Dorsal view of right mandible, showing marginal teeth. (Enlarged approx. 30 X.)

PLATE 3.

Two new species of Constrictotermes with perconstricted heads.

FIG. 10. ***Constrictotermes incisus*** Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 35 X.)

11. ***Constrictotermes incisus*** Snyder. Soldier. Lateral view of head and pronotum. (Enlarged approx. 30 X.)

12. ***Constrictotermes briciae*** Snyder. Soldier. Dorsal view of head and pronotum. (Enlarged approx. 35 X.)

13. ***Constrictotermes briciae*** Snyder. Soldier. Lateral view of head and pronotum. (Enlarged approx. 35 X.)

PLATE 4.

Wing venation of Kalotermitidae.

FIG. 14. ***Kalotermes montanus*** Snyder. Venation of fore wing. (Enlarged approx. 7.5 X.)

15. ***Kalotermes immigrans*** Snyder. Venation of hind wing of type. (Enlarged approx. 12 X.)

16. ***Neotermes connexus*** Snyder. Venation of fore wing. (Enlarged approx. 8 X.)

PLATE 5.

Wing venation of Kalotermitidae and Termitidae.

FIG. 17. ***Cryptotermes rospigliosi*** Snyder. Venation of fore wing. (Enlarged approx. 10 ×.)

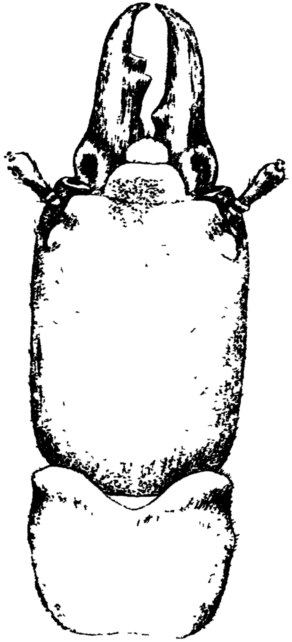
18. *Cryptotermes piceatus* Snyder. Venation of fore wing of type. (Enlarged approx. 8 ×.)

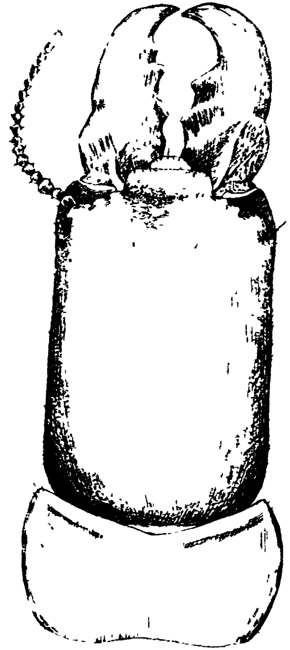
19. *Cryptotermes piceatus* Snyder. Venation of hind wing of type. Note differences in median vein. (Enlarged approx. 8 ×.)

20. *Cryptotermes brevis* Walker. Venation of fore wing. (Enlarged approx. 12 ×.)

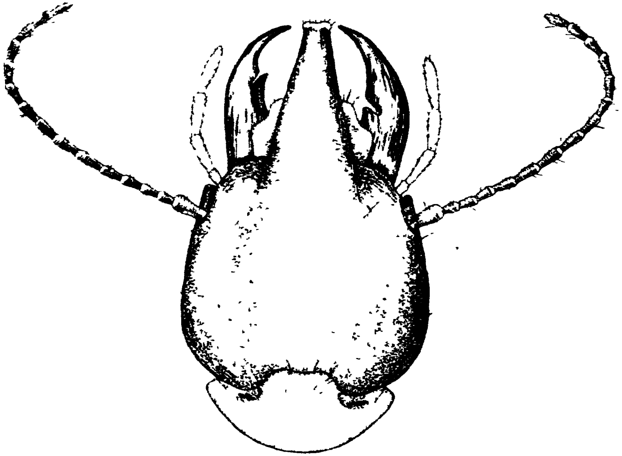
21. *Coptotermes niger* Snyder. Venation of fore wing. (Enlarged approx. 10 ×.)

22. *Anoplotermes gracilis* Snyder. Venation of fore wing. (Enlarged approx. 10 ×.)





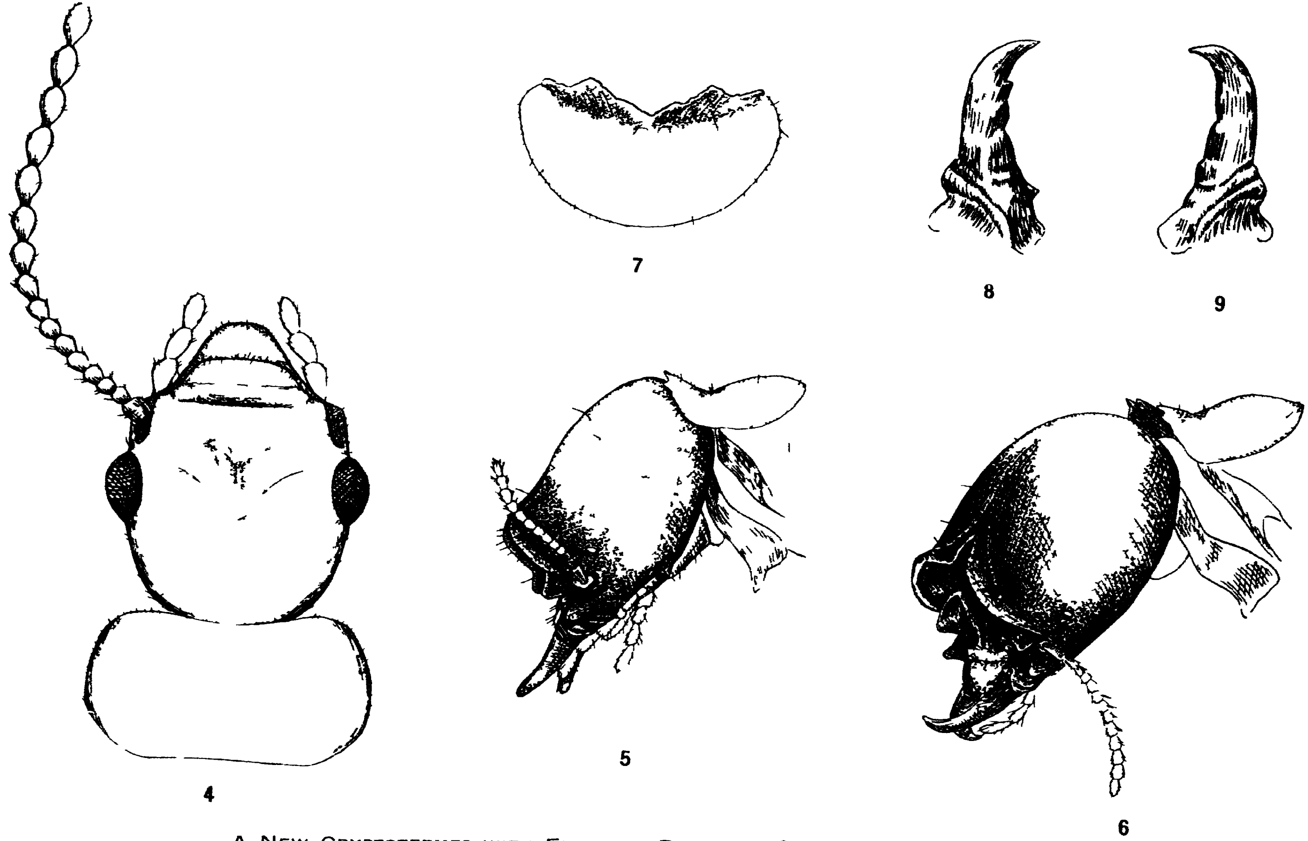
2



3

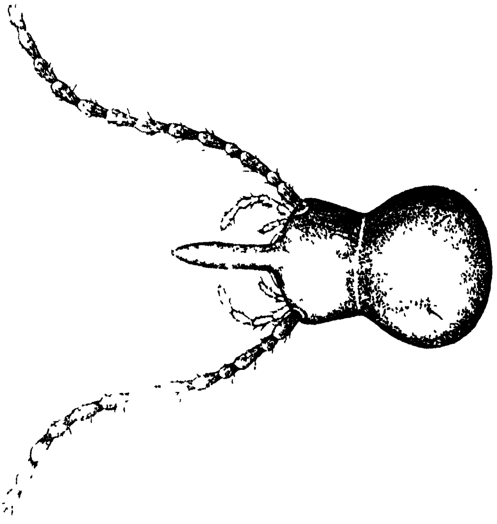
NEW SPECIES OF KALOTERMES AND ARMITERMES

FOR EXPLANATION OF PLATE SEE PAGE 31.

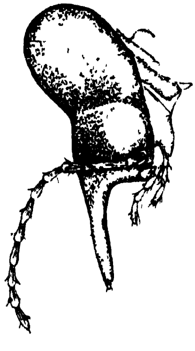


A NEW CRYPTOTERMES WITH FRONT OF PRONOTUM SERRATE IN SOLDIER CASTE

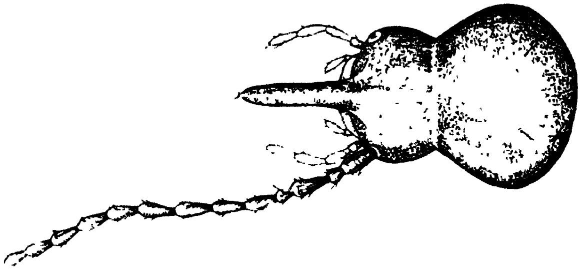
FOR EXPLANATION OF PLATE SEE PAGE 1



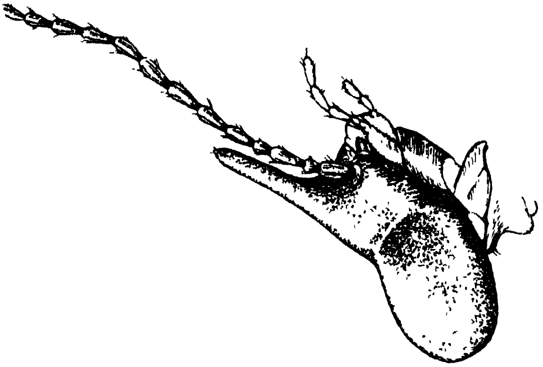
10



11



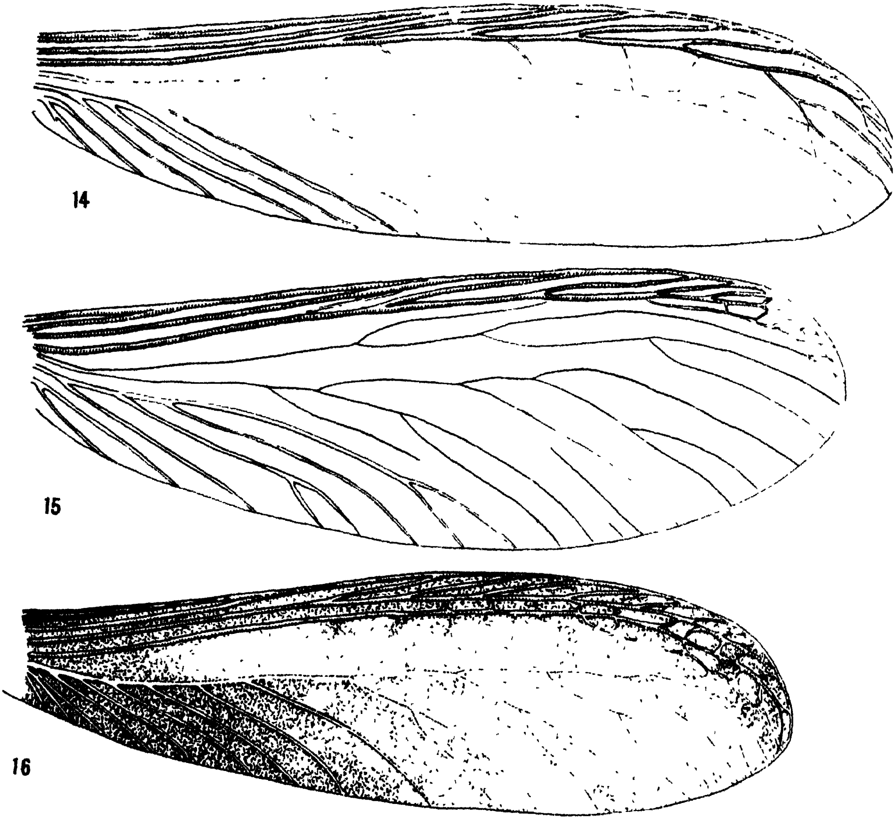
12



13

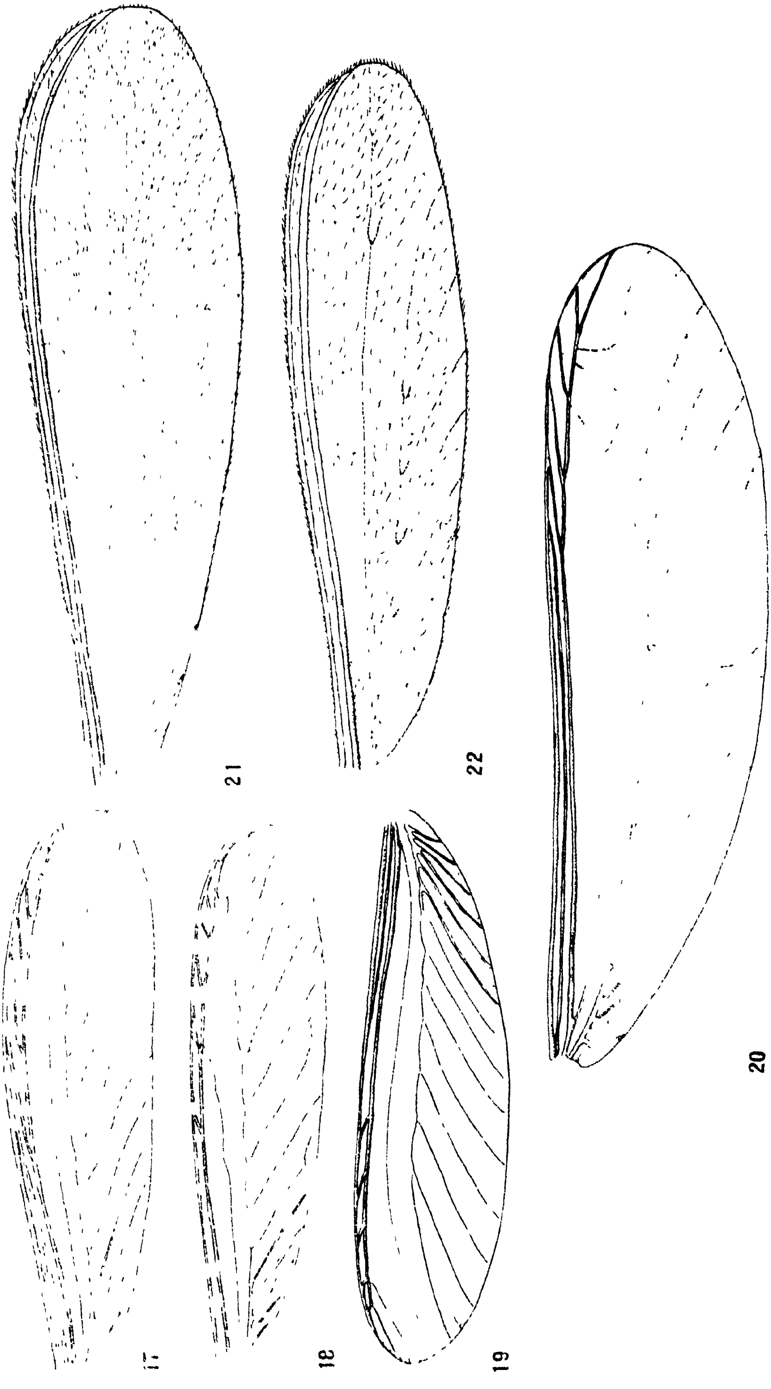
Two New Striking Species of Constrictotermes with Perconstricted Heads.

For explanation of plate see page 31.



WING VENATION OF KALOTERMITIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 31



WING VENATION OF KALOTERMITIDAE AND TERMITIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 32

DESCRIPTIONS OF SOME NORTH AMERICAN SAWFLY LARVAE.

By William Middleton,

Of the Bureau of Entomology, United States Department of Agriculture.

INTRODUCTION.

The following paper, which is a contribution from the Branch of Forest Insects, Bureau of Entomology, describes the larvae of certain sawflies which have been obtained in connection with investigations on insects injurious to forest and shade trees and shrubs. The species here treated belong to eight genera, representing four subfamilies, of the Tenthredinidae and one genus (*Acordulecera*) of the Pterygophoridae The genera represented are briefly characterized and keys, separating the larvae described, are included. Some brief remarks, based on notes made in the rearing work on the life and seasonal histories of the species, are added.

In the descriptions of the larvae the author has used the terminology which he had previously adopted for chalastogastrous larvae.[1] This terminology recognizes four transverse dorsal areas denoted by the letters A, B, C, and D and four pleural areas termed preepipleurite, postepipleurite, prehypopleurite, and posthypopleurite The spiracle, spiracular area, and alar area are considered as pertaining to the tergum or to the integument between tergum and pleurum and are treated after the discussion of the transverse tergal areas. The ambulatory appendages of the thorax have been designated by "legs" and those of the abdomen by "uropods" excepting on the ultimate segment, where they are called "postpedes." These appendages are herein treated following the discussion of the pleural areas since they occur between the pleurum and the sternum. The transverse dorsal areas A, B, C, and D may become subdivided, and when so are denoted by B^1, B^2, or C^1, C^2, and C^3. In order that the position of pigment or external morphological characters may be definitely indicated, the body has been divided into a series of imaginary longitudinal regions, placed one below the other on each side of

---

[1] LeConte's Sawfly, An Enemy of Young Pines, Jour. Agri. Research, vol. 20, No. 10, pp. 741–760, and Some Suggested Homologies between Larvae and Adults in Sawflies, Proc. Ent. Soc. Wash., vol. 23, No. 8, pp. 173–192, 1921.

No. 2442—Proceedings U. S. National Museum, Vol. 61, Art. 21.

the larva beginning with a middorsal line and ending with a midventral line. These regions are named and defined as follows:

I^a.—Middorsal, a single, longitudinal midtergal line.

I.—Dorsal, a pair of longitudinal tergal regions, one to each side of the middorsal line.

II.—Subdorsal, a pair of longitudinal tergal regions, one to each side of the dorsal regions.

III.—Laterodorsal, longitudinal regions, below the subdorsal regions.

IV.—Supraalar, regions, one on each side of larva below laterodorsal regions.

V.—Alar, regions, one on each side of larva below the supraalar regions and wherein the spiracle is situated on the larvae described in the present paper.

VI.—Epipleural, regions, below the alar.

VII.—Pleural, regions, below the epipleural.

VIII.—Hypopleural or lateroventral, paired regions, in which the hypopleurites are situated one to either side of the sternum and below the pleural regions.

IX.—Adventral, paired longitudinal regions in which the uropods protrude from the hypopleurites.

X.—Ventral, a pair of longitudinal regions, one to either side of the midventral line.

X^a.—Midventral, a single, midsternal longitudinal line.

The rearing of the insects was done at the eastern field station of the Bureau of Entomology, located at East Falls Church, Virginia, and the paper prepared under the direction of Mr. S. A. Rohwer, who has described the adults of such species as were new to science and identified those adults previously described.

The types of the larvae here described are in the collection of the United States National Museum.

Family TENTHREDINIDAE.

Subfamily EMPRIINAE.

Genus PERICLISTA Konow.

The larvae of the two species described in this genus are readily distinguished from each other in the arrangement of the spines and from the other sawfly larvae on the character of their spines, the larger of which are usually bifurcate and rarely trifurcate.

PERICLISTA HICORIAE Rohwer.

In Dyar's[2] "Synopsis of the Larvae of the North American Blennocampinae" the larva of this species falls in with (*Isodyctium*)

---

[2] Dyar, Journ. N. Y. Ent. Soc., vol. 6, June, 1898, p. 137.

Periclista murtfeldtiae and *infrequens*, but differs from these, which have spines black tipped or black at base and tip, in that the spines are pale. It agrees very well with the supplementary description of *caryicola* (sic: *calricolum*[3]), which records that species as possessing spines "nearly normally furcate and others perfectly normal," although they are described as more or less degenerate in the last stage (VI). *Periclista hicoriae* and *caryicola* are further associated by the use of the same host—hickory.

Larva.—STAGE VI? (Specimen in poor condition.)

Size.—Length, 13 mm., maximum breadth at metathorax 2.25 mm.

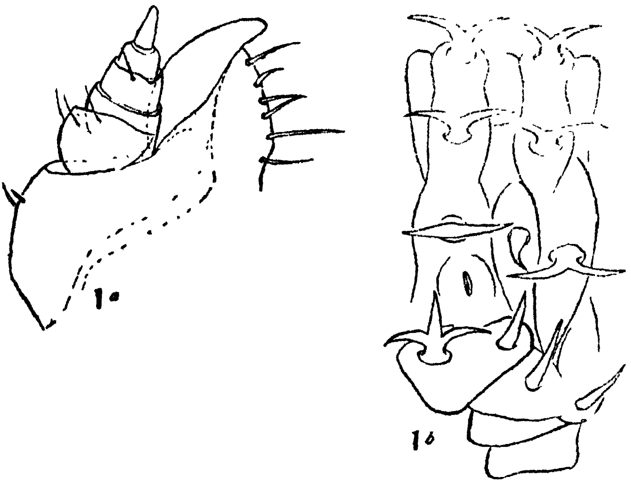


FIG. 1.—PERICLISTA HICORIAE ROHWER. *a*, MAXILLA; *b*, THIRD URITE.

Structure.—Head: Face view, circular in outline; epistoma with 6 spines in a transverse row; labrum with about 12 spines; epicranium and frons moderately spined; antennae of the telescopic type with 5 joints; eye disks not elevated, eyes slightly convex; maxilla with palpifer and 4 jointed palpus, lacinia broad and flattened and with a few (6) setae arranged on apical margin (fig. 1^a); labium with palpiger and 2-jointed palpus. Thorax: with large spines; legs with 4 joints and an apical claw, joints moderately haired, joint 3 with small chitinous process at apex of inner side. Abdomen: Uropods on urites 2–8, and postpedes on urite 10, (urites 4 and 10 chosen for describing because condition of the larvae would not permit complete study); tergum; composed of A, B, C (C inclined to subdivision into C^{1-2}) and D; B and C^2 armed with large bifurcate spines, B in subdorsal, laterodorsal and supraalar regions, C^2 in subdorsal and laterodorsal regions, on urites 1–9 (Fig. 1^b); urite 10, epiproct with many large spines; spiracular area rather small, with a rather small spiracle; alar area bilobed—the anterior lobe, below C^1, smaller and with a smaller, usually unforked spine—posterior lobe, below C^2, larger and with a large bifurcate spine; pleurum; preepipleurite and postepipleurite with 2 spines each, the anterior frequently bifurcate or trifurcate, the other three becoming smaller and often unforked posteriorly; hypopleurite and uropods present and without spines.

---

[3] Dyar, Journ. N. Y. Ent. Soc., vol. 6, June, 1898, p. 135.

Color.—Head: Paler green than body; eye disks black; mouthparts brownish; antennae green and prominent. Body: Leaf green, alimentary canal darkened in center; spines white; legs semitransparent, pale green with brown hook.

Prepupa.—

Size.—Length, 9 mm. Head: 1.25 mm. high by 1.25 mm. broad.

Structure.—Spineless, smooth, uropods somewhat reduced; otherwise same as larva.

Color.—Head: White; eye disks black; apices of mandibles blackish brown. Body: White; hooks on legs, the only darkened portions of body, brownish.

Cocoon.—Length, 6.5 mm. by 3 mm. broad. A blackish brown, single-walled case, with particles of sand or earth adhering.

Host.—*Hicoria*, species.

Remarks.—Described from material collected May 24, 1913, at Charter Oak, Pennsylvania, by Thomas E. Snyder and recorded under Hopk. U. S. number 11364. The larvae feed from the under surface of the leaf, eating small holes. All the larvae had finished feeding and had entered the ground to spin their cocoons by June 6, and on May 7 of the following year adults emerged in the rearing cage.

PERICLISTA SIMILARIS Rohwer.

In Dyar's[4] Synopsis this species runs to *Periclista albicollis*, but appears to be nearer *P. purpuridorsum* in that *albicollis* has a tuberculate prepupa while the prepupa of *similaris* and *purpuridorsum* are spineless and in that the larvae of these two rest on the under side of leaves, while the larvae of *albicollis* rest on the upper side. It is separated from *P. purpuridorsum* of the table, by being pale green, not darkened dorsally.

Larva.—STAGE VI. (Larva in poor condition.)

Structure.—Head: Face view, circular in outline; epistoma and labrum each with four spines; epicranium and frons sparsely spined; antennae of the telescopic type with 5 joints; eye disks not elevated, eyes slightly convex; maxilla with palpifer and 4-jointed palpus, lacinia, broad and flattened with a number (8) setae arranged on the apical and interior[5] margins (fig. 2^a); labium with palpiger and 2-jointed palpus. Thorax: With large spines; legs with 4 joints and apical claw, joints haired, joint 3 with small process at apex on inner side. Abdomen: (urites 5 and 10 chosen for describing because condition of larva would not permit complete study) tergum; of urites 1–9 composed of areas A, B, C (C inclined to subdivide forming a narrow C^1 and broad C^2) and D; B and C^2 armed with large bifurcate subdorsal and supraalar spines (fig. 2^b); urite 10, tergum consists of epiproct, with large and unforked spines in transverse caudal row and several smaller unforked spines; spiracular area rather small situated in alar region and containing a rather small spiracle; alar area bilobed—the anterior lobe, below C^1, smaller and with small, unforked, alar spine—the posterior lobe, below C^2, larger and with large, bifurcate, alar spine; pleurum; preepipleurite and postepipleurite distinct and separate, preepipleurite with a bifurcate spine anterior of a smaller unforked spine, neither as large as the tergal spines; postepipleurite with two unforked spines; hypopleurite and uropods present and without spines; uropods on urites 2–8, no uropods on urites 1 and 9, postpedes on urite 10.

---

[4] Dyar, Journ. N. Y. Ent. Soc., vol. 6, June, 1898, p. 136.

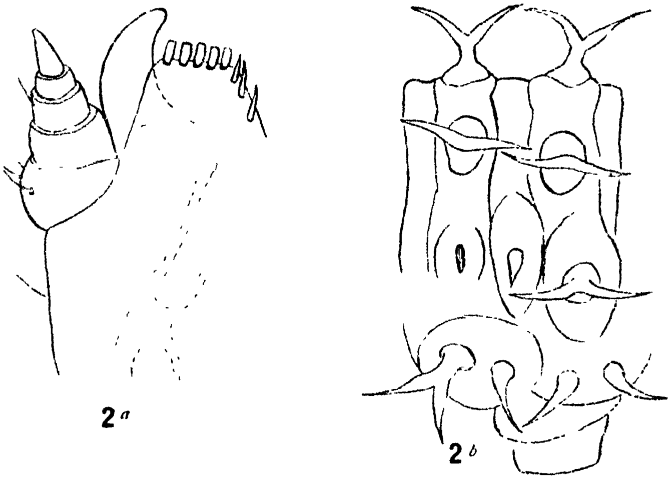


FIG. 2.—PERICLISTA SIMILARIS ROHWER *a*, MAXILLA; *b*, THIRD URITE

Color.—Head: Epicranium brownish black above eyes; upper half of frons brownish black; eye disks black; labrum, ventral mouth parts and antennal joints, pale brownish; apices of mandibles brown; remainder pale green. Body: Leaf green, alimentary canal showing darker; spines of tergum and alar area black; preepipleurite and postepipleurite and smaller epiproctal spines pale or occasionally the larger spines pale with brownish tips.

---

[5] Exterior with reference to maxillary palpus and galea.

Prepupa.—Size.—14.5 mm. long. Head: 2.33 mm. high by 2.2 mm. broad.

Structure.—Similar to stage VI larva.

Color.—Much as stage VI larva; vertex of head undarkened; spiracles blackish.

Cocoon.—Pupation occurs in a capsule-shaped cell of sand or earth cemented together by the prepupae, similar to those made by certain other Tenthredinidae. 13 mm. long by 7 mm. broad.

Host.—*Sambucus canadensis* Linnaeus.

Remarks.—Described from material collected June 26, 1912, at Falls Church, Virginia, by S. A. Rohwer, and recorded under Hopk. U. S. number 10144. The larvae were of various sizes at time of collection, the fourth to sixth stages being present. The elderberry was in flower or with young fruit at this time. The larvae sit either flat on edge or somewhat curled on the under side of leaf. All the larvae had entered the ground for pupation on July 13, 1912, and June 3, 1914, adults emerged in the rearing cages.

MACROPHYA TRISYLLABA Norton.

Larva.—STAGE VI.

Structure.—Head: Face view, circular in outline; epistoma with 4–6 spines; labrum with 6 spines; frons and epicranium moderately haired; eye disks not elevated, eye lenses slightly convex; antennae of the telescopic type with 5 joints; maxilla with a palpifer and 4-jointed palpus, lacinia broad and flattened, with a number of setae (10–12) arranged on the apical margin (similar to *M. epinota*, see fig. 3^a); labium with a palpiger and 2-jointed palpus. Thorax: Tergum; prothorax composed of A, B, C^{1-2}, and D; mesothorax and metathorax composed of A, B^{1-2}, C^{1-2}, and D; in prothorax A and D are bare while B and C are sparsely spined; in mesothorax and metathorax A is haired, B^1 bare, B^2 sparsely spined, C^1 sparsely spined, C^2 and D bare; alar area large, not distinctly separated from preepipleurite and sparsely haired in the mesothorax and metathorax; alar area absent in prothorax; pleurum; preepipleurite not large, sparsely haired; postepipleurite large and sparsely haired in the prothorax, small and bare in the mesothorax and metathorax; prehypopleurite chitinized, triangular and sparsely haired; posthypopleurite rather small and sparsely haired; legs with 4 joints and an apical claw, joints sparsely haired and joint 3 with a long, broad, and well chitinized extension at apex on inner side of leg. Abdomen: The tergum consists of A, B^{1-2}, C^{1-2-3}, and D on urites 1–8, with urite 9 the same, excepting that B and C are but indistinctly subdivided and a subdivision of C is wanting, and with urite 10 consisting of an epiproct without pseudocerci; spiracular area with spiracle present on urites 1–8 and wanting on urites 9 and 10; alar area bilobed on urites 1–7, single lobed on urites 8 and 9, and wanting on urite 10; pleurum: preepipleurite and postepipleurite, separate and distinct on urites 1–8, not separate, but forming an epipleurite on urite 9, and not recognizable on urite 10; hypopleurite and uropods on urites 2–8; hypopleurite undeveloped or absent and uropods wanting on urites 1 and 9; hypopleurite not distinguishable, postpedes present, and postcallus moderately haired and not especially prominent on urite 10.

Color.—Head: Epicranium mostly brownish black, excepting posterior laterodorsal grooves, which are white and a white area extending across pleurostoma below eye disks and along the frontal epicranial sutures; eye disks black; remainder of head, excepting labrum and mandibles, white; labrum and mandibles yellowish-brown. Thorax and abdomen: dorsum above alar region blackish with pale, narrow, middorsal, longitudinal stripe and large whitish subdorsal spots on $B^{1\text{-}2}$, $C^{1\text{-}2\text{-}3}$ and D; alar area dark; pleurum and venter, pale but for preepipleurite and postepipleurite which have dark markings; ultimate segment, dorsum above pleurum grayish—darker at the cephalad laterad angles and darkest at a moderately large blackish spot on the dorsad caudad margin of the epiproct; pleurum and venter, pale.

Prepupa.—

Structure.—Head: Similar to that of the larva, but bare excepting for four hairs each, on epistoma and labrum. Thorax: Similar but bare. Abdomen: Similar but bare, including epiproct and postcallus.

Color.—Head: Pale with black eye disks. Thorax and abdomen, pale with a few faint grayish markings on pleurum and a number on the dorsum.

Cocoon.—Pupation occurs in a capsule-shaped cell of sand or earth cemented together by the prepupae. Cell 12 mm. long by 8 mm. broad.

Host.—*Sambucus canadensis* Linnaeus.

Remarks.—Material described was collected at East River, Connecticut, on September 3, 1916, by C. R. Ely and recorded under Hopk. U. S. number $13660p^{1\text{-}2}$. Prepupae first appeared September 14 and by October 9 all were in the ground. Adults emerged in the latter part of May and early June of the following year.

MACROPHYA NIGRISTIGMA Rohwer.

Larva.—STAGE VI.

Structure.—Head: Face view, circular in outline, viewed from side wedge-shaped; epistoma with 4 to 6 spines; labrum with 6 spines; frons moderately haired, epicranium densely but finely haired; eye disks not elevated, the lenses slightly convex; antennae of the telescopic type with 5 joints; maxilla with a palpifer and 4-jointed palpus, lacinia broader than *M. epinota* or *trisyllaba* and flattened with many setae (20) on apical margin; labium with palpiger and 2-jointed palpus. Thorax: With the tergum of the prothorax composed of areas A, B, C^{1-2} and D; B and C^2 with few indistinct spines; the mesothorax and metathorax A, B^{1-2}, C^{1-2}, and D; B^2 and C^1 with few indistinct spines; alar area absent in the prothorax, large, much divided, but not especially prominent in the mesothorax and metathorax; pleurum; preepipleurite not distinctly separated from alar area, not large; postepipleurite small; prehypopleurite angular, somewhat chitinized and haired; posthypopleurite of medium size, no distinct spines; legs sparsely haired, 4 joints and claw, joint 3 with a rather large process at apex on inner side. Abdomen: The tergum of urites 1–8 composed of A, B^{1-2}, C^{1-2-3} and D; B^2 and C^2 with sparse, indistinct spines; urite 9 the same but with a subdivision of C wanting; urite 10 composed of epiproct, moderately spined and without pseudocerci; spiracular area, situated in alar region, well defined, and with a large spiracle on urites 1–8, wanting on urites 9 and 10; alar area distinctly bilobed on urites 1–7, indistinctly bilobed on urite 8, indistinct on urite 9 and wanting on urite 10; pleurum; epipleurite divided into distinct preepipleurite and postepipleurite on urites 1–8; epipleurite undivided on urite 9 and not distinguishable on urite 10; uropods from distinct hypopleurite on urites 2–8; no uropods or distinct hypopleurite on urites 1 and 9; postpedes but no distinct hypopleurite, and postcallus rather large and moderately haired on urite 10.

Color.—Head: Epicranium brownish black; pleurostoma below eyes, lateral margins of occiput, posterior laterodorsal grooves and margins of frontal epicranial suture, whitish; eye disks black; remainder of head whitish. Thorax and abdomen, prothorax, white, except brownish D; mesothorax and metathorax and abdomen, dorsum above alar region brownish; A and B^1 in middorsal region, alar area under B^2 in supraalar region and preepipleurite, with blackish spots on mesothorax and metathorax; B^{1-2} in middorsal region, B^2 in supraalar region, alar area in alar region, preepipleurite in epipleural region, with blackish spots on urite 1; urites 2-8 inclusive, same but with an alar spot below spiracle on the spiracular area and postepipleurite with blackish spot; urite 9, B^{1-2} in middorsal region, B^2 in supraalar region and epipleurite with spots; urite 10 with small supraalar spot at sides.

Prepupa.—

Structure.—Head: Similar to larva, but epistoma and labrum thickened and fleshy. Thorax and abdomen, similar to larva but with spines wanting.

Color.—Head: Epicranium darkened, grayish tan above eyes; eye disks black; apices of mandibles black; remainder of head yellowish white. Thorax and abdomen, very faintly yellowish gray where the larva is brownish; with faint gray spots where the larva has blackish spots.

Cocoon.—Pupal cells or cocoons not obtained but they are doubtless the same as the other two species of this genus.

Host.—*Hicoria*, species.

Remarks.—Described from material collected August 6, 1914, at Linglestown, Pennsylvania, by W. S. Fisher, and recorded under Hopk. U. S. number 10959^{a}. The larvae were abundant and fed vigorously during the morning and evening but not in the heat of the day. All these larvae had entered the ground for pupation by August 17, 1914, but no adults emerged.

The lack of emergence from this cage throws the possibility of doubt as to the identity of the larvae; however, they agree so well with the other larvae of the genus *Macrophya* and since an adult of *Macrophya nigristigma* Rohwer was taken from these plants about the same time the larvae were collected the adults and larvae have been associated.

Subfamily ALLANTINAE.

The following larvae differ from the other sawfly larvae herein described in that their antennae have 5 joints and that urites 1–8 inclusive have the tergum composed of areas A, B, $C^{1\text{-}2\text{-}3}$ and D, with B and C^2 haired (fig. 4^b).

The present description of one of the species was prepared from a shed skin supplemented by rearing notes and hence is not so complete as might be wished. Because of this the genera to which the larvae belong can not be adequately defined, only color characters being available for differentiation.

Genus PSEUDOSIOBLA Ashmead.

PSEUDOSIOBLA FLORIDANA Provancher.

Larva.—(Poorly preserved specimen.)

STAGE III or IV?

Size.—11 mm. long. Head: 1.5 mm. high by 1.33 mm. broad.

Structure and color.—Similar to stage VI.

STAGE VI.

Size.—13.5 mm. long. Head: 2.33 mm. high by 2 mm. broad.

Structure.—Head: Face view, circular in outline, somewhat wedge-shaped viewed from side; epistoma with 4 spines; labrum with 6 spines; frons and epicranium sparsely haired; eye disks not elevated, lenses slightly convex; antennae of the telescopic type with 5 joints;

maxilla with a palpifer and 4-jointed palpus, lacinia broad and flattened with many (16) setae on apical margin (fig. 4^a); labium with palpiger and 2-jointed palpus. Thorax: The tergum of the prothorax composed of areas A, B, C, and D; B and C sparsely but distinctly spined; mesothorax and metathorax, tergal areas A, B, C spined and D bare; alar area of prothorax wanting but large and somewhat divided in the mesothorax and metathorax; pleurum; preepipleurite large, indistinctly separated from B in the prothorax and the alar area in the mesothorax and metathorax; postepipleurite of moderate size; prehypopleurite triangular, somewhat chitinized and haired; posthypopleurite of medium size; legs with 4 joints and an apical claw, joints sparsely haired, joint 3 with rather long process at apex of inner side. Abdomen: The tergum of urites 1–8 composed of A, B, C^{1-2-3} and D with B and C^2 sparsely but distinctly spined (fig. 4^b); urite 9 the same but with a subdivision of C wanting; urite 10 consisting of an epiproct sparsely but distinctly spined and with no pseudocerci; spiracular area in the alar region fairly distinct and with a rather large spiracle on urites 1–8, wanting on urites 9 and 10; alar area distinctly bilobed and each lobe spined on urites 1–8, indistinct on urite 9 and wanting on urite 10; pleurum; epipleurite divided into distinct preepipleurite and postepipleurite with both spined on urites 1–8, epipleurite not distinctly divided on urite 9, and not distinguishable on urite 10; uropods and a distinct hypopleurite present on urites 2–8; no uropods and no distinct hypopleurite on urites 1 and 9; postpedes present but no distinct hypopleurite on urite 10.

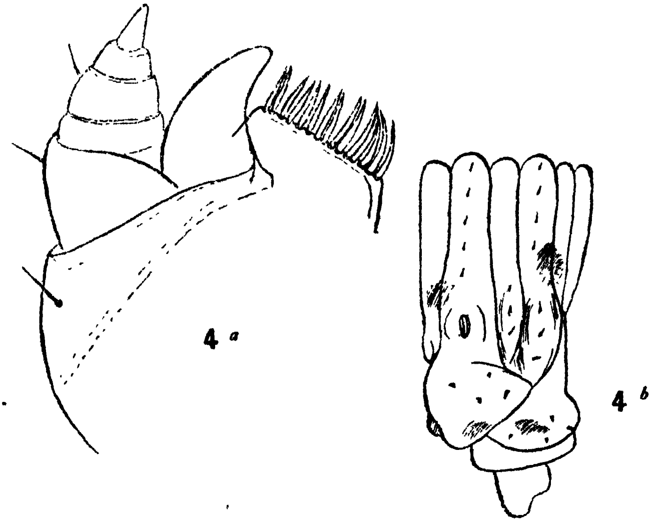


FIG. 4.—PSEUDOSIOBLA FLORIDANA ASHMEAD. *a*, MAXILLA; *b*, THIRD URITE.

Color.—Head: Blackish above eyes, pale below; eye disks black; antennal joints brown. Thorax: Legs brownish to blackish. Thorax and abdomen, with supraalar and pleural rows of spots; remainder of larva pale.

Prepupa.—Appears same as other stages.

Cocoon.—Spins no cocoon but prepupa cements particles of sand or earth together into a capsule-shaped case, 11 mm. long by 6 mm. broad, similar to other Tenthredinidae.

Host.—*Cephalanthus occidentalis* Linnaeus.

Remarks.—Described from material collected June 27, 1912, at Newington, Virginia, by S. A. Rohwer, and recorded under Hopk. U. S. number 10145. At this time the flower buds varied from about the size of a pea to the size of a marble. The larvae were of several sizes and were found feeding solitary, on edge of the leaves. They feed stretched along the edge of leaf but are sometimes found curled. The larvae are easily disturbed and fall, curled, to the ground. All the larvae had entered the ground for pupation by July 10, 1912, and on June 7 of the following year adult sawflies were found in cage.

Genus STRONGYLOGASTEROIDEA Ashmead.

STRONGYLOGASYEROIDEA PALLIDICORNIS Norton.

Larva.—STAGE VI.

Size.—Length 15 mm. Head: 2.5 mm. high by 2 mm. broad.

Structure (from shed skin).—Head: Face view, circular in outline; epistoma with 4 hairs; labrum with 6 hairs; epicranium and frons rather sparsely haired; eye disks not elevated, eyes slightly convex; antennae of the telescopic type with 5 joints; maxilla with palpifer and 4-jointed palpus, lacinia broad and flattened with a number of setae (12) on apical margin; labium with palpiger and 2-jointed palpus.

Color (from rearing notes). –Head: Powdery, large dorsal blackish spot between posterior laterodorsal grooves and down vertex to near the junction of the frontal epicranial sutures above frons; eye disks black, with brownish black markings posterior to them. Body: Tergum and pleurum bluish white, with bloom or white powder and spotted with black, a middorsal row 1 per segment, a subdorsal row 3 per segment, and alar or supraalar row 2 per segment; venter including legs and uropods, yellowish.

Cocoon.—Spins no cocoon, pupates in cell of sand or earth cemented together. Cell, capsule-shaped; length, 15 mm.; width, 7.5 mm.

Host.—*Rubus*, species.

Remarks.—Described from material collected July 29, 1913, at Falls Church, Virginia, by William Middleton and recorded under

Hopk. U. S. number 11388. The larvæ were feeding upon the edges of the leaves and were in the sixth stage. On August 4 they had shed, becoming prepupae and had entered the ground for pupation. Adults emerged on August 25 of the same year.

Subfamily NEMATINAE.

Tribe NEMATINI.

The larvae described below may be distinguished from the other larvæ herein treated by the possession of a cone and disk type antenna with 4 joints or parts (fig. 7^b), and a broad and flattened lacinia armed with setae along the apical margin. The following table will serve to separate the larvae here described:

1. Area A with several hairs........ 2.
Area A bare........ 3
2. Pseudocerci present........ **Croesus castaneae.**
Pseudocerci wanting........ **Pteronidea amelanchieridis.**
3. Pseudocerci present........ 4.
Pseudocerci wanting........ 6.
4. Lower seta or tube on anterior lobe of the alar area in black spot.
Pteronidea winnanae.
Same seta or tube not in black spot........ 5.
5. Postepipleurite of mesothorax and metathorax blackish.
Pteronidea mendicana
Same areas pale........ **Pteronidea plesia.**
6. Second joint from base of the maxillary palpus with fleshy process at apical end of the inner side........ 7.
Same joint without process........ **Pontania amentivora.**
7. Area C indistinctly subdivided, forming C^{1-2} with C^1 haired........ 8.
Area C indistinctly subdivided, forming C^{1-2-3} with C^3 haired.
Pristiphora betulavora.
8. Feeding on *Corylus*........ **Pteronidea corylus.**
Feeding on *Alnus*........ **Pteronidea alnivora.**

Genus CROESUS Leach.

CROESUS CASTANEAE Rohwer.

Larva.—STAGE IV.

Size.—15 mm. long. Head: 1.66 mm. high by 1.66 mm. broad.

STAGE V.

Size.—17 mm. long. Head: 2 mm. high by 2 mm. broad.

STAGE VI.

Size.—25 mm. long. Head: 2.5 mm. high by 2.33 mm. broad.

Structure.—Head: Face view, circular in outline; epistoma and labrum with 4 spines each and epicranium and frons sparsely spined; eye disks not elevated, eye slightly convex; antennae of the cone and disk type, basal membrane with disks protruding, disks 4 in number, nearly complete and joint-like; maxilla with palpifer and 4-jointed palpus, the apical 2 joints quite small, lacinia broad, flattened and armed on the apical margin with 12–13 bristles; labium with palpiger and 2-jointed palpus. Thorax: The tergum consists of areas A, B, C, and D; A, except in the prothorax, B and C are haired sparsely; A prothorax bare and constricted, D bare and narrow; mesothorax and metathorax with enlarged alar area which is sparsely haired and not well separated from preepipleurite; pleurum; preepipleurite large and sparsely haired; postepipleurite of moderate size and bare; prehypopleurite triangular, of heavy chitin and sparsely haired; posthypopleurite large and sparsely haired; legs with 4 joints and an apical claw, joint 3 with soft pad on inner side at apex. Abdomen: The tergum of urites 1–9, inclusive, is composed of areas A, B, C, and D; A, B, and C are sparsely haired and D is bare and narrow and urite 10 consists of an epiproct, which is sparsely haired and poscesses pseudocerci at caudad laterad extremities; urites 1–8, inclusive, with spiracle in the spiracular area but urites 9 and 10 have both the spiracle and the spiracular area wanting; urites 1–8, inclusive, with the alar area distinct, bilobed and sparsely haired, urite 9 with the alar area not distinct and urite 10 with the alar area wanting; pleurum; urites 1–7, inclusive, with preepipleurite distinct and separate from postepipleurite and both sparsely haired, urite 8 with preepipleurite indistinctly separated from postepipleurite and both sparsely haired, urite 9 with preepipleurite indistinguishably united with postepipleurite and sparsely haired, and urite 10 with epipleurite not recognizable; urites 2–7, inclusive, with hypopleurite distinct and not divided into prehypopleurite and posthypopleurite, and urites 1, 8, 9, and 10 with hypopleurite indistinct or wanting; urites 2–7, inclusive, with well-developed uropods, urites 1, 8, and 9 with uropods wanting and urite 10 with postpedes and with a rather prominent postcallus (fold below anus).

Color.—Head: Black; the epistoma, labrum, maxillae, and labium are pale yellow with some brown; the antennal membrane is pale. Thorax: The prothorax is pale yellow, excepting the brownish neck plates and sometimes the spiracular area has faint dark markings; the mesothorax is pale yellow, with a brownish-black transverse band, broken middorsally and extending down B across the anterior portion of the alar area and the preepipleurite and terminating on the lateroventral extremities of the first and second sternal folds; the metathorax is the same. Abdomen: Urite 1 is pale with a brownish black, transverse band which is broken middorsally and extends down B and across the spiracular area to, and terminating on, the anterior portion of preepipleurite; urites 2–8 are similar, but with the band not terminating on the preepipleurite but extending across the venter on the second, or first and second, sternal areas of each segment; urite 9 is similar to urite 1, but has the transverse band terminating at the alar region, and urite 10 is entirely pale yellow.

Prepupa.—Size: 11 mm. long. Head: 2.25 mm. by 2.25 mm.; much similar to the larva in structure and color.

Cocoon.—12 mm. long by 5 mm. broad; black; single-walled; typical *Croesus* cocoon.

Host.—*Castanea dentata* (Marshall) Borkhausen.

Remarks.—Described from material collected August 7, 1912, at Falls Church, Virginia, by S. A. Rohwer and William Middleton and recorded under Hopk. U. S. number 10154, supplemented by material collected August 30, 1912, at Vienna, Virginia, by R. A. Cushman and recorded under Hopk. U. S. number 10154^a and September 21, 1912, at Blythedale, Maryland, by C. T. Greene, recorded under Hopk. U. S. number 11323.

The larva of this species is a gregarious edge eater and seems to be rare, since only 4 or 5 colonies have been collected. The larvae that were collected August 7, 1912, had finished feeding and had entered the ground for pupation by August 17, 1912. Adults emerged in the rearing cage on September 16, 1912.

Genus PTERONIDEA Rohwer.

PTERONIDEA AMELANCHIERIDIS Rohwer.

Larva.—STAGE VI.—

Structure.—Head: Nematine in type; antennae of the cone and disk type which are but slightly jointlike and 4 in number; maxilla with palpifer and 4-jointed palpus, lacinia broad and flattened with 15 or so bladelike setae along apical margin and this armature with a large gap near galea (fig. 5); labium with palpiger and 2-jointed palpus. Thorax: The tergum with A prothorax and D of prothorax, mesothorax and metathorax bare, A of the mesothorax and metathorax and B and C of the prothorax, mesothorax, and metathorax with a few short hairs; B and D terminating in the alar region with acute angles, due to enlarged, broad, and sparsely haired alar area which is well separated from preepipleurite; the pleurum with preepipleurite, prehypopleurite, posthypopleurite and leg joints sparsely haired; legs with 4 joints and a claw, joint 3 with large pad on inner side at apex. Abdomen: The tergum of urites 1–9, inclusive, is composed of A, B, C, and D (B and C are not as distinctly separated as A and B or C and D, and C is inclined to subdivide C^{1-2-3}); A, B, and C^2 with few hairs, D bare and narrow; urite 10 composed of epiproct which is sparsely haired and without pseudocerci; urites 1–8, inclusive, contain spiracle in a rather well defined spiracular area and urites 9 and 10, without spiracular area and spiracle; urites 1–9, inclusive. with alar area neither well developed nor distinctly bilobed, wanting on urite 10; pleurum; urites 2–7, inclusive, possessing well-developed preepipleurite, postepipleurite. hypopleurite, and uropods, the preepipleurite, postepipleurite, and uropods with a few short hairs; urites 1, 8, and 9 preepipleurite and postepipelurite not distinct as two separate areas but united to form an epipleurite; the hypopleurite not distinct as an area and the uropods not developed; urite 10, the pleurum is not developed as in preceding urites. postpedes are present and the postcallus is moderately prominent and haired.

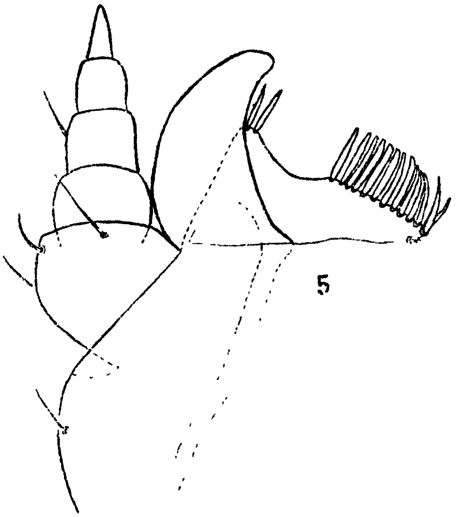


FIG. 5.—PTERONIDEA AMELANCHIERIDIS ROHWER MAXILLA.

Color.—Head: Tan, eye disks black, mouthparts brownish. Body: Dull, pale whitish green.

Cocoon.—9 mm. long by 4 mm. broad; coarse, single-walled and capsule-shaped; light brown in color and spun in ground.

Host.—*Amelanchier canadensis* (Linnaeus) Medicus.

Remarks.—Described from material collected July 16, 1916, at East River, Connecticut, by C. R. Ely and recorded under Hopk. U. S. number 13649^{e2}. The larvae at the time of collection were quite small and were found feeding on the under surface of leaves. All the larvae had become prepupae. entered the ground and spun cocoons by September 19, 1916, and on May 21 of the following year adults appeared in the cage.

PTERONIDEA WINNANAE Rohwer.

Larva.—STAGE IV.

Size.—Length, 7.5 mm. Head: 1 mm. high by 1 mm. broad.

Structure.—Similar to stage V.

STAGE V.

Size.—Length, 11 mm. Head: 1.25 mm. high by 1.17 mm. broad.

Structure.—Similar to stage VI.

STAGE VI.

Size.—Length, 14 mm. Head: 1.5 mm. high by 1.5 mm. broad.

Structure.—Head: Face view, circular in outline; epistoma and labrum with 4 hairs each and epicranium and frons, sparsely haired; eye disks not elevated and eyes slightly convex; antennae of the cone and disk type, cone as long as basal diameter, membrane with disks slightly prominent, disks, except outermost, are bands partially surrounding cone, outermost a free plate, disks 4 in number and not joint-like; maxilla with palpifer and 4-jointed palpus; third joint from apex with fleshy process on inner side, lacinia broad and flattened, with 12 setae on apical margin and no break or gap in this armature (fig. 6); labium with palpiger and 2-jointed palpus. **Thorax:** The tergum, composed of areas A, B, C, and D; A, excepting in prothorax, and B and C sparsely haired, A prothorax bare and constricted, D bare and narrow; mesothorax and metathorax with enlarged alar area (A and B terminating in alar region with acute angles) which is sparsely haired and rather well separated from preepipleurite; prothorax with the alar area absent; pleurum; preepipleurite rather large and sparsely haired; postepipleurite rather large and bare; prehypopleurite large, triangular, heavily chitinized and sparsely haired and posthypopleurite large and sparsely haired; legs with 4 joints and an apical claw, joint 3 with a small, soft pad on inner side at apex. **Abdomen:** The tergum of urites 1–9, inclusive, is composed of areas A, B, C, and D (C somewhat inclined to subdivide C^{1-2}, with C^1 haired, on urites 2–7); B and C are sparsely haired, A bare and D bare and narrow; urite 10 consists of an epiproct, which is sparsely haired and has pseudocerci at the caudad laterad extremities; urites 1–8, inclusive, with spiracular area containing spiracle, but urites 9 and 10 have the spiracle wanting and the spiracular area is not demarked; urites 1–7, inclusive, have the alar area large, distinct, bilobed, and sparsely haired, urites 8 and 9 with the alar area smaller, sparsely haired and not distinctly bilobed, and urite 10 with the alar area wanting; pleurum; urites 1–8 preepipleurite distinct and separate from postepipleurite, both sparsely haired, urite 9 with preepipleurite and postepipleurite not separated, but forming an epipleurite which is sparsely haired, and urite 10 with epipleurite not recognizable; urites 2–7 with hypopleurite distinct and not divided into prehypopleurite and posthypopleurite; urites 1, 8, 9, and 10 with hypopleurite indistinct or wanting; urites 2–7, inclusive, with well-developed uropods; urites 1, 8, and 9 uropods wanting and urite 10 with postpedes and with a rather prominent postcallus which is thickly haired.

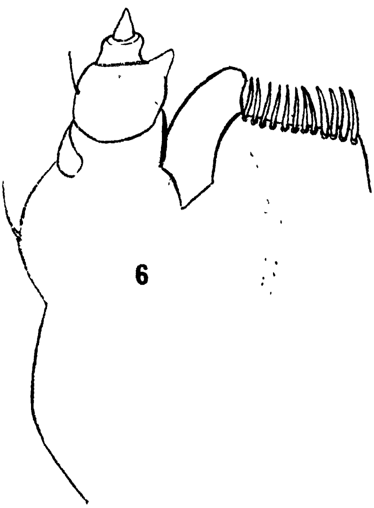


FIG. 6.—PTERONIDEA WINNANAE ROHWER. MAXILLA.

Color.—Head: Brownish black; the epistoma, labrum, maxillae, and labium yellow to yellowish brown; antennal and mandibular membranes pale. Thorax: Prothorax pale orange yellow, excepting the brownish neck plates, laterodorsal spot on D, prehypopleurite which is yellowish, posthypopleurite which is grayish and the leg joints which are blackish; mesothorax, pale green, with middorsal and laterodorsal brownish spots on A, laterodorsal on B, middorsal and laterodorsal on D, under B and C on the alar area and on preepipleurite, postepipleurite, and posthypopleurite; a transverse band on C; prehypopleurite and leg joints with blackish heavy chitin; metathorax, similar. Abdomen: Urite 1 pale greenish yellow with middorsal and laterodorsal brownish spots on A, B, C, and D, supraalar on B, C and the alar area, alar on the alar area, epipleural on preepipleurite and A, pleural on postepipleurite and hypopleural on that portion of the segment corresponding with the hypopleurite of urites 2–7; urites 2–7, inclusive, the same but with the hypopleural brown spot on the hypopleurite; urite 8, much similar to urite 1; urite 9 almost entirely pale greenish yellow, but with the alar area and epipleurite each brownish; and urite 10 epiproct greenish yellow with posterior half between the pseudocerci black.

Prepupa.—Size: Length 10 mm. Head: 1.5 mm. high by 1.5 mm. broad.

Structure.—Similar to the larva.

Color.—Head: Brownish. Body: Similar to the larva, excepting that the middorsal line is wanting and that the epiproct is gray posteriorly between pseudocerci.

Cocoon.—8.5 mm. long by 3.5 mm. broad, capsule-shaped, blackish in color, consisting of single case, thin, but finely woven. Cocoons are generally found in sand or earth, particles of which adhere to them.

Host.—*Salix*, species.

Parasites.—*Diaborus mediatus* Cresson (Determined S. A. Rohwer).

Remarks.—Described from material collected August 21, 1912, at Ballston, Virginia, by William Middleton and recorded under Hopk. U. S., number 11316.[b] These larvae cling to and feed on the edge of leaves with their abdomen curled on the under surface. All had become prepupae and entered the ground to spin their cocoons by August 31, 1912. Adults emerged in considerable numbers on September 9, 1912, and parasites on September 16 and 21, 1912.

PTERONIDEA MENDICANA Rohwer.

P. mendicana much similar to *P. winnanae*, differing from the latter species in larger size and having the lower seta or tubercle of the anterior lobe of the alar area not in blackened spot, while that of *P. winnanae* is in black spot.

Larva.—STAGE VI.

Structure.—Head: Face view, circular in outline; epistoma and labrum with 4 hairs each, epicranium sparsely haired and frons bare or nearly so; eye disks not elevated and eye lenses slightly convex; antennae of the cone and disk type (fig. 7^b), cone as long as diameter at base, membrane with disks rather prominent, disks except outermost are bands partially or wholly surrounding cone, outermost a small free plate, disks 4 in number and somewhat joint-like; maxilla with palpifer and 4-jointed palpus, lacinia similar to that of *P. winnanae;* labium with palpifer and 2-jointed palpus. Thorax: The tergum composed of areas A, B, C, and D; A, excepting in the prothorax, B and C are sparsely haired; A of the prothorax bare and constricted, D bare and narrow; mesothoracic and metathoracic alar area enlarged (causing A and B to terminate in alar region with acute angles), sparsely haired and well separated from preepipleurite; alar area absent on prothorax; pleurum: preepipleurite rather small in prothorax, large in the mesothorax and metathorax; postepipleurite rather large and bare; prehypopleurite large, triangular, heavily chitinized and sparsely haired; posthypopleurite rather large and sparsely haired; legs with 4 joints and an apical claw, joint 3 with small, soft pad on inner side at apex. Abdomen: The tergum of urites 1–9, inclusive, is composed of areas A, B, C, and D (C indistinctly subdivided $C^{1\text{-}2\text{-}3}$) (fig. 7^a), B and C^2 are sparsely haired, A is usually bare and D is bare and narrow; urite 10 consists of the epiproct, which is sparsely haired and possesses pseudocerci at laterad caudad extremities; urites 1–8, inclusive, with spiracle in a rather well defined spiracular area; urites 9 and 10 with the spiracle wanting and the spiracular area not demarked; urites 1–7, inclusive, with a large, distinct, bilobed and sparsely haired alar area, urites 8 and 9 with the alar area smaller, sparsely haired, and not distinctly bilobed and urite 10 with the alar area wanting; pleurum; urites 1–7, inclusive, with preepipleurite distinct and separate from postepipleurite and both large and sparsely haired, urite 8

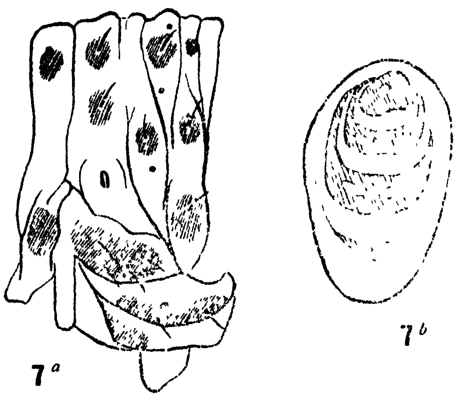


FIG. 7 – PTERONIDEA MENDICANA ROHWER *a*, THIRD URITE; *b*, ANTENNA.

with preepipleurite rather distinct from postepipleurite both large and sparsely haired, urite 9 with preepipleurite and postepipleurite forming epipleurite and not distinctly separated and sparsely haired; urite 10 with epipleurite not recognizable; urites 2–7, inclusive, with hypopleurite distinct, not subdivided into prehypopleurite and posthypopleurite and not haired and urites 1, 8, 9, and 10 with hypo pleurite indistinct or wanting; urites 2–7, inclusive, with well-developed uropods, urites 1, 8, and 9 with uropods wanting, and urite 10 with postpedes and with a rather prominent, thickly haired postcallus.

Color.—Head: Brownish black, membranes pale, eye disks deep black. Thorax: Prothorax pale, excepting grayish markings on postepipleurite and posthypopleurite; neck plates, leg joints, and prehypopleurite brownish black; mesothorax pale with brownish middorsal line and brownish black laterodorsal spots on A, B, C, and D; alar area with supraalar and alar blackish spots; preepipleurite, postepipleurite, prehypopleurite, posthypopleurite, and leg joints, blackish; metathorax similar to mesothorax. Abdomen: Urite 1 pale with middorsal and laterodorsal brownish black spots on A, B, C, and D; supraalar spots on B and the alar area; alar spots on A and the alar area; epipleural spot on preepipleurite and a pleural spot on postepipleurite; urites 2–7, inclusive, similar to urite 1, but further possessing a lateroventral spot on hypopleurum; urite 8 similar to those preceding, but with spots fainter and occasionally several wanting; hypopleurite not distinct but lateroventral spot present, however; urite 9 mostly pale, excepting the alar area and epipleurite and urite 10 pale with the epiproct blackish posteriorly.

Cocoon.—9 mm. long by 4 mm. broad; single-walled, close woven, capsule-shaped structure; brownish black in color.

Host.—*Salix*, species.

Parasites.—*Masicera*, species (determined by C. T. Greene).

Remarks.—Described from material collected September 23, 1913, at Harrisburg, Pennsylvania, by A. B. Champlain and recorded under Hopk. U. S. number 11398^r. All had become prepupae, gone into ground and spun cocoons by October 28, 1913. On May 26, the following year, an adult diptera emerged in cage. Adult sawflies began emerging on July 24, 1914, and continued to issue until August 3, 1914.

PTERONIDEA PLESIA Rohwer.

Like *P. mendicana* but with postepipleurite pale on prothorax, mesothorax, and metathorax.

Larva.—STAGE VI.

Structure.—Head: As *P. mendicana*. Thorax: As *P. mendicana*. Abdomen: As *P. mendicana*.

Color.—Head: As *P. mendicana.* Thorax: Prothorax pale, excepting neck plates and leg joints, which are black; mesothorax pale, excepting laterodorsal blackish spots on B and C, grayish spots on preepipleurite and postepipleurite and black prehypopleurite and leg joints; metathorax the same but with small grayish middorsal spot on A and the alar area with a supraalar gray spot. Abdomen: Urite 1 pale, with grayish middorsal spot on A, laterodorsal blackish spots on A, B, and C; supraalar blackish spots on B and one on each lobe of the alar area, alar spot on the posterior lobe of the alar area, preepipleurite and postepipleurite with black spots; urites 2–6, inclusive, similar to urite 1, but possessing a lateroventral spot on hypopleurite; urite 7 similar to 2–6, but without lateroventral spot on hypopleurite; urite 8 pale, excepting laterodorsal spot on B, supraalar spots on B and the alar area and blackish preepipleurite and postepipleurite; urite 9 pale and with spot on epipleurite and urite 10 pale with large black spot dorsad caudad on epiproct.

Host.—Populus grandidentata Michaux.

Remarks.—Described from material collected August 7, 1916, at East River, Connecticut, by C. R. Ely and recorded under Hopk. U. S. number 13656^{z3}. Adults emerged August 25, 1916.

PTERONIDEA ALNIVORA Rohwer.

Egg.—The eggs are laid in the mid or side ribs on the under side of the leaf.

Larva.—STAGE VI.

Structure.—Head: Face view, circular in outline; epistoma and labrum with 4 hairs each and epicranium and frons sparsely haired; eye disks not elevated and eye slightly convex; antennae of the cone and disk type, cone longer than basal diameter, membrane with disks rather prominent, disks except outermost are bands partially or wholly surrounding cone, outermost a free plate, disks 4 in number and joint-like; maxilla with palpifer and 4-jointed palpus, lacinia much similar to *P. winnanae;* labium with palpiger and 2-jointed palpus. Thorax: The tergum is composed of areas A, B, C, and D; A, excepting in prothorax, B and C are sparsely haired; A of the prothorax is bare and constricted, D bare and narrow; mesothorax and metathorax with the alar area enlarged, sparsely haired and well separated from preepipleurite (A and B terminating in alar region with acute angles); the alar area absent in the prothorax; pleurum; preepipleurite rather small in the prothrorax and large in the mesothorax and metathorax, sparsely haired; postepipleurite rather large and bare; prehypopleurite large, triangular, heavily chitinized, and sparsely haired; posthypopleurite rather large and sparsely haired; legs with 4 joints and an apical claw, joint 3 with small, soft pad on inner side at apex. Abdomen: The tergum of urites 1–9, inclusive, is composed of areas A, B, C, and D (C slightly inclined to subdivide C^{1-2}), B and C^1 are sparsely haired, A is usually bare (occasionally with one or two hairs), and D is bare and narrow; urite 10 consists of an epiproct which is sparsely haired and without pseudocerci; urites 1–8, inclusive, with the spiracle in a rather well-defined spiracular area and urites 9 and 10 with the spiracle wanting and the spiracular area not demarked; urites 1–7, inclusive, with the alar area large, distinct, bilobed and sparsely haired, urites 8 and 9 with the alar area smaller, sparsely haired and not bilobed, and urite 10 with the alar area wanting; pleurum; urites 1–7 with preepipleurite distinct and separate from postepipleurite, both large and sparsely haired, urites 8 and 9 preepipleurite and postepipleurite not distinctly separated and forming epipleurite which is sparsely haired and urite 10 with epipleurite not recognizable; urites 2–7, inclusive, with hypopleurite distinct and not divided into prehypopleurite and posthypopleurite and urites 1, 8, 9, and 10 with hypopleurite indistinct or wanting; urites 2–7, inclusive, with well-developed uropods, urites 1, 8, and 9 with uropods wanting and urite 10 with postpedes and with a rather prominent postcallus which is thickly haired.

Color.—Head: Black to yellow brown; portions of epistoma, labrum, maxilla, labium and membranes of antennae and mandibles, pale; eye disks black. Thorax and abdomen, with a broad, tergal (to supraalar line) bronze brown, longitudinal band; spiracular area pale but alar area bronze brown and confluent with the tergal band; preepipleurite dark brown; D posterior of the alar area and area between preepipleurite and postepipleurite pale; postepipleurite dark brown; urites 2–7, inclusive, with the anterior of hypopleurite brownish; uropods brown, apex pale and with large ventral spots; urite 1 with small faint, brownish, lateroventral spot; venter pale; urites 8 and 9 with a rather large ventral spot and urite 10 pale.

Cocoon.— 8 mm. long by 4 mm. in diameter; capsule-shaped, single-walled, of fine texture and colored blackish brown.

Host.—*Alnus*, species.

Parasites.—*Polyterus olympiae* Ashmead, *Homalomma pteronideae* Rohwer.

Remarks.—Described from material collected October 11, 1912, at Falls Church, Virginia, by William Middleton and recorded under Hopk. U. S. number 11329^{b2} supplemented by notes from material collected same time and place and recorded under Hopk. U. S. number 11329^{b1}. These larvae were found feeding gregariously on the edges of the leaves carrying their abdomens S-shaped. On October 27, 1912, most of the larvae had become prepupae and cocooned—some among the leaves and some in the sand on the bottom of the cage.

Adults began emerging May 9, 1913, and continued to issue until May 24, 1913. Parasites emerged May 24 and June 11, 1913. This species has also been collected at Dismal Swamp, Virginia, and East River and Lyme, Connecticut.

PTERONIDEA CORYLUS (Cresson).

Eggs.—The eggs are laid in August about first to middle of month. They are placed in slits made in the midrib of the hazel leaf on the under side. The egg is about 1 mm. long and 0.25 mm. wide; oval. Hatching: In hatching the eggs seem to become distended just before it is time for the young larvae to emerge. A bubble-like protrusion appears, sometimes in the middle and sometimes at one end of the egg membrane. This bubble seems to disappear as soon as the larva begins its struggle to emerge. The larva usually emerges from the shell, head first, but sometimes backs out. It rests for one or two hours before beginning to feed.

Larva.—STAGE VI.

Structure.—Similar to *P. alnivora.*

Color.—Head: Blackish. Body: Similar to *P. alnivora* but less dark brown.

Cocoon.—9 mm. long by 4 mm. in diameter; single-walled; medium texture; capsule-shaped and brownish black in color; is spun in ground.

Host.—*Corylus*, species.

Remarks.—Described from material collected July 21, 1915, at East River, Connecticut, by C. R. Ely and recorded under Hopk. U. S. number 10752^b. These larvae were found feeding gregariously on the edge of the leaves. The first cocoons appeared August 2, 1915, and cocoon spinning continued until August 17, 1915. Adults emerged August 20 to September 9, 1915.

Genus PRISTIPHORA Latreille.

PRISTIPHORA BETULAVORA Rohwer.

Larva.—STAGE VI.

Structure.—Head: Similar to *Pteronidea;* antennae of the cone and disk type, cone about as long as basal diameter, consisting of 4 joints; maxilla with palpifer and 4-jointed palpus, apical 2 palpi joints small, second basal joint with process at apex on inner side, lacinia broad and flattened with an unbroken row of setae on apical margin (similar to *P. winnanae*); labium with palpiger and 2-jointed palpus. Thorax: The tergum is composed of A, B, C, and D and a rather large alar area in the mesothorax and metathorax; the pleurum is composed of preepipleurite, postepipleurite, prehypopleurite, and posthypopleurite, which are similar to *Pteronidea;* and the legs have 4 joints and an apical claw; the prothorax with A, D, and p epipleurite bare; B, C, preepipleurite, prehypopleurite, posthypopleurite and leg joints sparsely haired; mesothorax with D and postepipleurite bare; A, B, and C, alar area, preepipleurite, prehypopleurite, posthypopleurite, and leg joints, sparsely haired; the metathorax same as the mesothorax. Abdomen: The tergum of urites 1–9 is composed of areas A, B, C, and D (C inclined to subdivide $C^{1\text{-}2\text{-}3}$), A and D are bare, B and C are sparsely haired and urite 10 consists tergally of an epiproct which is sparsely haired and without pseudocerci; urites 1–8, inclusive, with spiracle in a rather well-defined spiracular area and the alar area is bilobed and sparsely haired, urite 9 with the spiracle and spiracular area wanting and the alar area wanting or not distinct and urite 10 with spiracle, spiracular area and alar area wanting; in the pleurum; urites 2–7, inclusive, with preepipleurite, postepipleurite, hypopleurite, and uropods, urites 1 and 8 with a rather distinct preepipleurite but with indistinct postepipleurite and hypopleurite and no uropods, urite 9 with the pleurum indistinct and no uropods, and urite 10 pleurum indistinct, postpedes present and with postcallus not very prominent; urites 1–9, preepipleurite, postepipleurite, and uropods sparsely haired, urite 10 postpedes sparsely haired and the postcallus rather thickly haired.

Color.—Head: Leaf green with few dusky marks. Body: Leaf green.

Cocoon.—9 mm. long by 3.5 mm. in diameter; thin, single-walled, medium texture, capsule-shaped or elliptical in outline with one or more flattened surfaces due to contact. Blackish brown in color.

Host.—*Betula alba* Linnaeus.

Remarks.—Described from material collected August 23, 1915, at East River, Connecticut, by C. R. Ely and recorded under Hopk. U. S. number 10757^d. All the larvae had shed becoming prepupae and spun their cocoons by September 10, 1915, and adults emerged in the cage on May 17 of the following year.

Genus PONTANIA Costa.

PONTANIA AMENTIVORA Rohwer.

Oviposition.—Oviposition occurs about the middle of April when the pistillate catkins are about half grown. The adults (observations from reared specimens in captivity) prefer, apparently, the medium and slightly developed catkins. Oviposition, in the large majority of cases, occurs at the tip of the bud. (Those exceptions observed are cases where large, nearly full developed buds are attacked; here oviposition is made at the basal swelling of the bud.) So far as could be observed the adults did not feel over a particular bud prior to attempting oviposition, but climb about irregularly over the buds, suddenly stopping, grasping one behind them at about the middle with the metathoracic legs, bending down the abdomen and inserting the ovipositor with a plough-like motion. If these actions constitute the entire technic of egg laying, which is uncertain since no eggs were recovered in the examination of the material, the time occupied by the disposition of one egg is extremely short. The author is of the opinion that, as these adults were cage-reared and their emergence probably retarded (infested aments observed April 18, 1913, while adult emergence in cage began April 10, 1914; see remarks), the buds were too advanced to be suitable for oviposition.

Larva.—At time of collection both years, 1912 and 1913, the larvae were more or less advanced, so that only the fourth to the sixth stages of the larvae and the prepupae are available for description.

STAGE IV.

Size.—Head: 0.67 mm. high by 0.67 mm. broad. Body: 6.5 mm. long.

Structure.—Similar to stage V.

Color.—Head: Dark. Body: Pale; markings very faint, more distinct on preepipleurite than on postepipleurite or elsewhere, though scarcely discernible.

STAGE V.

Size.—10 mm. long. Head: 0.87 mm. high by 0.75 mm. wide.

Structure.—Similar to stage VI.

Color.—Similar to stage VI; spot markings faint gray.

STAGE VI.

Size.—12 mm. in length. Head: 1.12 mm. high by 1 mm. wide.

Structure.—Head: Face view, circular in outline; epistoma and labrum with 4 spines each and epicranium and frons sparsely haired; eye disks not elevated, eye slightly convex; antennae of the cone and disk type, cone short and button-like, membrane with disks flat, disks, except the outermost bands, partially surrounding cone, outermost a free plate, disks 4 in number and not joint-like; maxilla with palpifer and 4-jointed palpus, apical 2 palpi joints quite small; second basal joint without process on inner side, lacinia not especially broad and flat, armed on apical surface with a few (8) setae forming a row; labium with palpiger and 2-jointed palpus. Thorax: The tergum is composed of areas A, B, C, and D; A, excepting in the prothorax, B and C are sparsely haired, A prothorax is bare and constricted, D is bare; mesothorax and metathorax with an enlarged alar area sparsely haired and not distinctly separated from preepipleurite; pleurum; preepipleurite large and moderately haired; postepipleurite of moderate or large size and bare; prehypopleurite triangular, of heavy chitin and sparsely haired; posthypopleurite large and sparsely haired; legs with 4 joints and an apical claw, joint 3 with small soft pad on inner side at apex. Abdomen: The tergum of urites 1–9, inclusive, is composed of areas A, B, C, and D (C inclined to subdivide into C^{1-2}), B and C^1 are sparsely haired and A and D are bare; urite 10 consists tergally of an epiproct, which is sparsely haired and without pseudocerci; urites 1–8, inclusive, with spiracle in spiracular area and urites 9 and 10 with spiracle wanting and the spiracular area not demarked; urites 1–8, inclusive, with the alar area distinct, bilobed, and sparsely haired, urite 9 the alar area smaller but distinct and haired and urite 10 with the alar area wanting; pleurum; urites 1–7, inclusive, with preepipleurite distinct and separate from postepipleurite, and both sparsely haired, urite 8 with preepipleurite indistinctly separated from postepipleurite and both sparsely haired, urite 9 with preepipleurite indistinguishably united with postepipleurite and forming a sparsely haired epipleurite and urite 10 with epipleurite not recognizable; urites 2–7, inclusive, with hypopleurite distinct and not divided into prehypopleurite and posthypopleurite and urites 1, 8, 9, and 10 with hypopleurite indistinct or wanting; urites 2–7, inclusive, with well-developed uropods, urites 1, 8, and 9 with uropods wanting and urite 10 with postpedes and postcallus of moderate size.

Color.—Head: Almost entirely dark brown; eye disks black. Thorax: White, except for gray spots about base of hairs on B and C of the prothorax, A, B, and C of the mesothorax and metathorax and preepipleurite and posthypopleurite of entire thorax, and the dark brown chitin of prehypopleurite, leg joints, and claw of entire thorax. Abdomen: White, with the spiracles gray and with faint gray spots about base of hairs on folds B and C, the alar area and preepipleurite and postepipleurite where separate and epipleurite where preepipleurite and postepipleurite are not separated, on urites 1–9, inclusive, and with very faint indistinct grayish markings on the epiproct of urite 10.

Prepupa.—(One that had not spun its cocoon and contracted.)

Size.—10 mm. in length. Head: 1 mm. high by 1 mm. wide.

Structure.—Similar to sixth stage of larva.

Color.—Head: Whitish; faintly gray in front; eyes and eye disks black; mandibles black. Thorax: Legs pale, otherwise similar to sixth larval stage with markings somewhat darker. Abdomen: Similar to sixth larval stage but with darker markings.

Cocoon.—5 mm. long by 2 mm. broad, capsule-shaped; brown in color; consists of single case, thin but finely or closely woven. The cocoon is generally in sand or earth, but occasionally in the cotton of the ament, with particles of sand or ament cotton adhering to it.

Pupa.—5.5 mm. long. Head: 1.25 mm. wide; dorsal epicranium to and including eyes, black; ventrally pale, including antennae and area basad; tips of mandibles brown. Body: The tergum darkened (nearly black) but paling somewhat posteriorly with the ultimate segment yellowish; the venter yellowish; and the legs and wings white.

Host.—*Salix humilis* Marshall.

Remarks.—Described from material collected April 21–23, 1915, at Falls Church, Virginia, by C. P. Heinrich supplemented by rearing notes from several other collections and some field observations. These larvae work in the pistillate aments of willow, causing a premature issuance of "cotton". The work was first observed April 18, 1913, and in the latter part of the month, April 23, 1913, the prepupae began to leave the aments and seek the ground for places to spin cocoons. The prepupae became pupae about the first of April, 1914, and issued as adults from about April 10–20. It is probable that these individuals were retarded considerably in that they were reared in cages under somewhat unnatural conditions and that these events occur about 15 days earlier in nature.

Family PTERYGOPHORIDAE.

Subfamily ACORDULECERINAE.

Genus ACORDULECERA Say.

The larvae described in the following pages differ considerably from those on the preceding pages. They can be readily distinguished by their antenna which consists of four circular disks not concentric but arranged to form a diamond or square (fig. 8^b) and the presence on the postepipleurite in certain abdominal segments (in the following on urites 2–4 and 8 and urites 2–5 and 8) of a prominent cresent-shaped area (fig. 8^c).

The following table separates the species described below:

1. Crescent-shaped area on urites 2 to 5 and 8........................**maura.**
   Crescent-shaped area on urites 2 to 4 and 8........................2.
2. Uropods on urites 2 to 7 about same size........................3.
   Uropods on urites 6 and 7 distinctly smaller than those on urites 2 to 5. **hicoriae.**
3. Head and apical leg joints brown or yellow brown........................**nigritarsis.**
   Head greenish white with dorsal brown spots; legs white except claw. **foveata.**

ACORDULECERA FOVEATA Rohwer.

Larva.—STAGE VI (?).

Structure.—Head: Face view, circular in outline, oval in outline viewed from side; labrum with 4 spines; epicranium and frons with a few short, stout hairs; eye disks not elevated, eyes slightly convex; antennae composed of 4 separate disks (not concentric) no cone (fig. 8^b); maxilla with larger palpifer and 4-jointed palpus, basal 2 joints of palpi not distinctly separated, lacinia neither especially broad nor flattened and armed an apical surface with few (6) setae in row (fig. 8^a); labium with palpiger and 2-jointed palpus. Thorax: The tergum composed of areas A, B, C, and D (D infolded); prothorax B and C with hairs; mesothorax and metathorax A, B, and C haired; alar area absent in the prothorax and medium sized, undivided, not especially prominent on mesothorax and metathorax; the pleurum with preepipleurite not very distinctly separated from B on the prothorax and from the alar area on the mesothorax and metathorax; postepipleurite small; prehypopleurite small, lobe-like rather than flat surfaced, with few hairs; posthypopleurite rather large, with several hairs; legs sparsely haired with 4 joints, a claw and a small pad or fleshy protuberance basad of claw and on posterior interior side of leg. Abdomen: The tergum, composed of A, B, C, and D (D infolded); A, B, and C with hairs, on urites 1 to 9 (fig. 8^c), and urite 10 composed of epiproct, which is moderately haired and possesses no pseudocerci; spiracular area small and indistinct, situated in alar region and with spiracle small on urites 1 to 8; spiracular area and spiracle wanting on urites 9 and 10; alar area neither prominent, large nor bilobed on urites 2 to 8; alar area less developed and smaller on urite 1, indistinct on urite 9, and wanting on urite 10; the pleurum with the epipleurite divided into small preepipleurite and small postepipleurite on urite 1, into small preepipleurite and larger postepipleurite with prominent crescent-shaped area on urites 2 to 4 and 8 (fig. 8^c), urites 5–7 similar to preceding but without crescent-shaped area, urite 9 with epipleurite undivided and urite 10 with epipleurite not distinguishable; uropods from an indistinct hypopleurite on urites 2 to 7, no uropods and hypopleurite indistinct on urites 1, 8, and 9, and postpedes present, hypopleurite wanting and the postcallus small, not prominent and but moderately haired on urite 10.

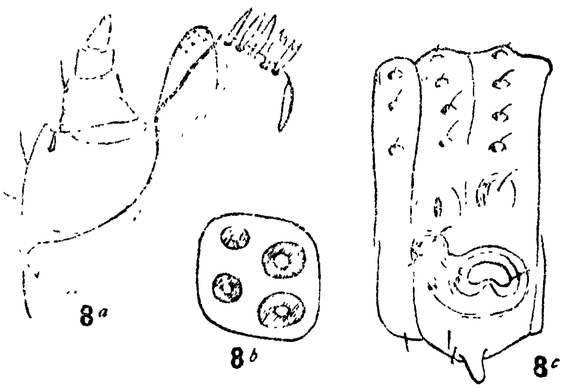


Fig. 8.—Acordulecera foveata Rohwer. *a*, Maxilla; *b*, antenna; *c*, third urite.

Color.—Head: Greenish white with two dorsal brownish spots, one posterior of other, on vertex; eye disks black; apices of mandibles brownish. Thorax: Pale shiny green, excepting subdorsal spots on C prothorax and A mesothorax, and brownish claw. Abdomen: Whitish entirely.

Cocoon.—5 mm. long by 2.5 mm. in diameter; thin, fine texture, single-walled, capsule-shaped, whitish case.

Host.—*Quercus alba* Linnaeus.

Remarks.—Material described was collected May 26, 1913, at East Falls Church, Virginia, by William Middleton and recorded under Hopk. U. S. number 11362, June 26, 1913. The species is also recorded from Great Falls and Dixie Landing, Virginia.

The larvae feed on the leaves from the under side of leaves and are not especially active. On May 31, 1913, all larvae were in ground. May 21, 1914, four adults emerged.

ACORDULECERA HICORIAE Rohwer.

Larva.—STAGE VI (?).

Structure.—Head: Similar to *A. foveata.* Thorax: Similar to *A. foveata*, but preepipleurite rather distinct from B in the prothorax and the alar area in the mesothorax and metathorax. Abdomen: similar to *A. foveata* but uropods on urites 6 and 7 more distinctly smaller than those on urites 2–5.

Color.—Head: Brownish black (occasionally with some white); eye disks black; mandibles, labrum, and joints and chitin of ventral mouth parts, brownish. Body: Pale yellowish green, nearly white, marked as follows: Legs with joints brown; prothorax with neck plates brown, C with large, subdorsal, brown spot, B with large, alar, brown spot, and preepipleurite, prehypopleurite and posthypopleurite brownish; mesothorax and metathorax A with subdorsal and supraalar brown spots, B with spot extending from subdorsal to supraalar regions, C similar but with the spots tending to divide into a subdorsal, laterodorsal, and supraalar spot. Abdomen: The tergum with A, B, and C similar on urites 1 to 9 (B and C spots confluent forming a large blotch on urites 5 to 9, inclusive); urite 10 with epiproct brownish; alar area brown on urites 1 to 8; the pleurum with preepipleurite brownish on urites 1 to 9; postepipleurite brownish on urites 1 to 8 (crescent-shaped areas on 2 to 4 and 8 white), with small spots on postepipleurite of urite 9; and urite 10 with entire pleurum pale. Larvae vary somewhat, the paler forms with the abdomen mostly devoid of brown. (These are usually younger larvae.)

Cocoon.—Similar to that of *A. foveata.*

Host.—*Hicoria*, species.

Remarks.—Material described was collected May 24, 1913, at Charter Oak, Pennsylvania, by Thomas E. Snyder and recorded under Hopk. U. S. number 11364[a], May 28, 1913.

The larvae feed at the edges of the leaves from the under side. By June 5, 1913, all the larvae had spun cocoons and on May 20, 1914, three adults had emerged.

ACORDULECERA NIGRITARSIS Rohwer.

Larva.—STAGE VI (?)

Structure.—Head: Similar to *A. hicoriae.* Thorax: Similar to *A. hicoriae.* Abdomen: Similar to *A. foveata.*

Color.—Head: Chitinous parts brown or yellowish brown. Body: Pale, legs with apical joints brown, basal joint occasionally yellow brown.

Cocoon.—Similar to *A. foveata.*

Host.—*Quercus marilandica* Muenchausen.

Remarks.—Material described was collected May 19, 1915, at Springfield, Virginia, by William Middleton and recorded under Hopk. U. S. number 13610. Adults emerged in cage May 2, 3, 5, 6, and 10, 1916.

ACORDULECERA MAURA Rohwer.

Larva.—STAGE VI (?).

Structure.—Head: Similar to *A. hicoriae.* Thorax: Similar to *A. hicoriae.* Abdomen: Similar to *A. foveata* but postepipleurite with prominent crescent-shaped areas on urites 2 to 5 and 8.

Color.—Head: Brown, brownish black across the posterior portion of the vertex; eye disks black; antennae brownish black. Body: Greenish white; legs yellowish or pale brown, no spots.

Prepupa.—Similar to larvae, excepting postpedes reduced and pale yellowish white.

Cocoon.—Similar to *A. foveata.*

Host.—*Castanea dentata* (Marshall) Borkhausen.

Remarks.—Material described was collected August 10, 1916, at East River, Connecticut, by Charles R. Ely and recorded under Hopk. U. S. number 13656[n].

All the larvae had spun cocoons on or gone into the ground by August 24, and adults emerged August 28 and 31, 1916.

STUDIES ON THE CYCLOSTOMATOUS BRYOZOA.

By Ferdinand Canu,
Of Versailles, France,

and

Ray S. Bassler,
Of Washington, District of Columbia.

During our studies of the North American Early Tertiary cyclostomatous Bryozoa, published as a part of our monograph of 1920,[1] we had occasion to extend our researches to many additional species, both living and fossil, for purposes of comparison and in order to test our classification. Our efforts were particularly directed to specimens bearing ovicells, as it is upon the function of reproduction that our classification is based in part. Species showing no ovicells, however, were also studied, often by means of thin sections, to determine the method of gemmation and the occurrence and variation in structure of the several kinds of adventitious and accessory tubes. Our notes upon these additional specimens contain so many new observations upon both described and undescribed species that we thought it advisable to publish them in a series of papers under the above general title.

1. FOSSIL AND RECENT PARALLELATA AND RECTANGULATA.

We have found Waters' two subdivisions of the Cyclostomata, the Parallelata, and Rectangulata to be not only convenient but valuable in classification. The present paper deals with both recent and fossil species of the Parallelata and Rectangulata genera listed on the following pages. A second paper now in preparation, discusses the Lower Cretaceous Cyclostomatous Bryozoa from the two classic localities, Farringdon, England, and Sainte Croix, Switzerland.

The researches herein recorded were made possible through a grant from the American Association for the Advancement of Science, for which assistance we are highly grateful.

---

[1] 1920, Canu and Bassler. North American Early Tertiary Bryozoa, Bull. 106 U. S. National Museum (2 vols.), 879 pages, 162 pls.

No. 2443—Proceedings U. S. National Museum, Vol. 61, Art. 22.

The classification of the ovicelled cyclostomatous bryozoa so far as our investigations have gone is expressed in the following table. It will be noted that many frequently cited genera are omitted from this classification. In such cases these genera either show no ovicells or, at least, ovicells have not been found in their genotypes so that they cannot at present be placed in a natural classification. In a future paper we hope to give a complete list of cyclostomatous genera indicating the status of each.

The student is referred to our monograph of 1920 for a discussion of the general structure of the Cyclostomata and a description of the various kinds of tubes, their methods of gemmation, the forms of zoarial growth and the types of ovicells developed. The present paper is supplementary to that work, which should be consulted in connection with it.

In these studies we employ the same terms of nomenclature as in our Early Tertiary monograph. All of these are self-evident except two measurement, which should be noted. There are (1) the separation of the tubes or peristomes, meaning the distance between two tubes opening at the same height, or, in other words, opposite each other and thus separated by another tube, and (2) the distance between the peristomes, indicating the measurement lengthwise along a single tube. These measurements include both peristomes concerned in the first instance and only the one belonging to the tube measured in the second.

Order CYCLOSTOMATA Busk.

Division OVICELLATA.

Subdivision PARALLELATA Waters, 1887.

Family ONCOUSOECIIDAE Canu, 1918.

**Oncousoecia* Canu, 1918; *Peristomoecia* Canu and Bassler, 1920; *Filisparsa* D'Orbigny, 1853.

Family CRISIIDAE Johnston, 1847.

Crisia Lamouroux, 1816; *Crisidia* Milne Edwards, 1838.

Family MACROECIIDAE Canu, 1918.

**Macroecia* Canu, 1918; **Atractosoecia*, new genus.

Family MECYNOECIIDAE Canu, 1918.

**Mecynoecia* Canu, 1918; **Trigonoecia*, new genus; **Cardioecia*, new genus; *Nematifera*, new genus; **Microecia* Canu, 1918; **Brachysoecia*, new genus; **Bisidmonea* D'Orbigny, 1852; *Entalophora* Lamouroux, 1821; *Exochoecia* Canu and Bassler, 1920.

Family PLAGIOECIIDAE Canu, 1918.

**Plagioecia* Canu, 1918; **Notoplagioecia*, new genus; *Desmeplagioecia* Canu and Bassler, 1920; **Terebellaria* Lamouroux, 1821, **Cavaria* Hagenow, 1851; **Cea* D'Orbigny, 1852; **Laterocea* D'Orbigny, 1852; **Stathmepora*, new genus.

Family DIAPEROECIIDAE Canu, 1918.

**Diaperoecia* Canu, 1918; **Diplosolen* Canu, 1918; **Stigmatoechos* Marsson, 1887; *Desmediaperoecia* Canu and Bassler, 1920; *Lekythionia* Canu and Bassler, 1920; *Crisulipora* Roberston, 1910.

Family TUBULIPORIDAE Johnston, 1838.

Tubulipora Lamarck, 1816; **Platonea* Canu and Bassler, 1920; *Centronea* Canu and Bassler, 1920; *Mesonea* Canu and Bassler, 1920; *Erkosonea* Canu and Bassler, 1920; **Pleuronea* Canu and Bassler, 1920; *Tretonea* Canu and Bassler, 1920; *Idmonea* Lamouroux, 1821; *Idmidronea* Canu and Bassler, 1920; **Tennysonia* Busk, 1867.

Family TERVIIDAE Canu and Bassler, 1920.

Tervia Jullien, 1882; *Lagonoecia* Canu and Bassler, 1920; *Prosthenoecia* Canu, 1918.

Family HORNERIDAE Gregory, 1899.

Hornera Lamouroux, 1821; *Crassohornera* Waters, 1887; *Phormopora* Marsson, 1887.

Family FRONDIPORIDAE Busk, 1875.

Frondipora Imperato, 1599; *Fasciculipora* D'Orbigny, 1846; *Discofascigera* D'Orbigny, 1852; *Apsendesia* Lamouroux, 1821.

Family CYTISIDAE D'Orbigny, 1854.

**Cyrtopora* Hagenow, 1851; **Plethopora* Hagenow, 1851; *Plethoporella*, new genus; *Retenoa* Gregory, 1909; *Cartecytis*, new genus; **Osculipora* D'Orbigny, 1849; **Diplodesmopora*, new genus; **Homoeosolen* Lonsdale, 1850; **Truncatula* Hagenow, 1851; **Discocytis* D'Orbigny, 1854; **Supercytis* D'Orbigny, 1854; **Unicytis* D'Orbigny, 1854; **Semicytis* D'Orbigny, 1854; **Desmepora* Lonsdale, 1850.

Genera marked * are considered in this paper.

Family THEONOIDAE Busk.

Theonoa Lamouroux, 1821; *Actinopora* D'Orbigny, 1853; *Multitubigera* D'Orbigny, 1853; *Radiofascigera* D'Orbigny, 1853; *Multifascigera* D'Orbigny, 1853; *Lopholepis* Hagenow, 1821; *Serietubigera* D'Orbigny, 1853.

Subdivision RECTANGULATA Waters, 1887.

Family LICHENOPORIDAE Smitt, 1866.

**Lichenopora* Defrance, 1823; *Orosopora* Canu and Bassler, 1920; *Trochiliopora* Gregory, 1909; *Conocava* Calvet, 1911.

LOBOSOECIIDAE new family.

**Lobosoecia*, new genus.

Family ELEIDAE D'Orbigny, 1852.

**Meliceritites* Roemer, 1840; **Cyclocites*, new genus.

CERIOCAVIDAE, new family.

**Ceriocava* D'Orbigny, 1852; **Ripisoecia*, new genus; **Grammecava*, new genus; **Spiroclausa* D'Orbigny, 1852; **Haplooecia* Gregory, 1896.

Family LEIOSOECIIDAE Canu and Bassler, 1920.

**Leiosoecia* Canu and Bassler, 1920; *Parleiosoecia* Canu and Bassler, 1920; **Ditaxia* Hagenow, 1851; **Chilopora* Haime, 1854.

Family TRETOCYCLOECIIDAE Canu, 1919.

**Tretocycloecia* Canu, 1919; *Partretocycloecia* Canu, 1919; **Alveolaria* Busk, 1859; *Telopora* Canu and Bassler, 1920; **Psilosolen*, new genus.

Family ASCOSOECIIDAE Canu, 1919.

**Ascosoecia* Canu, 1919; **Polyascosoecia* Canu and Bassler, 1920; **Parascosoecia* Canu, 1919; **Sulcocava* D'Orbigny, 1854; **Reteporidea* D'Orbigny, 1852; **Grammascosoecia*, new genus; **Crisina* D'Orbigny, 1850; **Cavarinella* Marsson, 1887; **Grammanotosoecia*, new genus; **Filicrisina* D'Orbigny, 1852; *Coelocochlea* Hagenow, 1851; *Laterocavea* D'Orbigny, 1852; *Siphodictyum* Lonsdale, 1849.

Family CORYMBOPORIDAE Smitt, 1866.

Corymbopora Michelin, 1845; *Fungella* Hagenow, 1851.

Subdivision PARALLELATA Waters, 1887.

The subdivision Parallelata, in which the axis of the ovicell parallels the zooecial axis, includes the majority of families of the Cyclostomata in which ovicells have been discovered and represents the most typical development of the order. The Rectangulata, on the other hand, where the ovicell axis is at right angles to the zooecial axis, embraces the "heteroporoid" genera, placed at one time in the Paleozoic order Trepostomata, but now known to be Cyclostomata, particularly on account of their ovicell structure.

Family ONCOUSOECIIDAE Canu, 1918.

1918. *Oncousoeciidae* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 16, p. 325.—1920. CANU and BASSLER. North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 687.

The axis of the ovicell is parallel to that of the tubes. The ovicell is developed at the same time as the adjacent tubes, which are not disarranged in their respective positions.

The known genera of this family are *Oncousoecia*, Canu, 1918, in which the ovicell is a dilation of the entire exterior part of the tube, and *Peristomoecia* Canu and Bassler, 1920, where the peristomie alone forms the ovicell.

Genus ONCOUSOECIA Canu, 1918.

1918. *Oncousoecia* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 16, p. 325.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 687.

The ovicell is a dilation of the entire exterior visible part of the tube. The oeciostome is not turned toward the base. Fourteen tentacles.

Genotype.—*Tubulipora lobulata* Hincks, 1880.

Range.—Cretaceous (Maastrichtian)—Recent.

The type of this genus is an incrusting form, but included in the genus is a number of species with the erect ramose manner of growth hitherto referred in part to *Filisparsa* and *Entalophora*. The genotype of *Filisparsa* D'Orbigny, 1852, *F. neocomiensis* D'Orbigny, 1852, shows no ovicell, but other species with the same zoarial growth exhibit several distinct types of ovicell. The position of *Filisparsa* in a natural classification, therefore, can not at present be determined.

and it is believed best to retain the name for species showing no ovicell, but with the zoarial form of growth consisting of erect ribbon-like branches with the zooecia opening on one face only. For convenience the zoarial form *Filisparsa* can be included in the Oncousoeciidae.

ONCOUSOECIA BIFURCATA Ulrich and Bassler, 1907.

Plate 1, fig. 1.

1907. *Filisparsa bifurcata* ULRICH and BASSLER, Geological Survey of New Jersey, Cretaceous, Paleontology, vol. 4, p. 322, pl. 22, fig. 8.

Measurements.—	Diameter of peristome	0.26–0.28	mm.
	Zooecial width	.36– .40	mm.
	Distance between orifices	.90	mm.
	Separation of peristomes	.90	mm.
	Dimensions of oeciostome	.34 by 0.18	mm.

We have been fortunate in discovering the ovicell of this *Filisparsa* and find that it is identical with that of *Oncousoecia varians* Reuss, 1869, and with that of *Oncousoecia quinqueseriata* Canu and Bassler, 1920, but it is more distinct from the genotype *Oncousoecia* (*Tubulipora*) *lobulata* Hincks, 1880. On the other hand, its oeciostome which is transverse and wider than a peristome, is of a quite divergent type and well characterizes the species. Exactly analogous oeciostones occur in *Macroecia*, but in this genus the ovicell is enormous and causes the abortion of a number of neighboring tubes.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, New Jersey.

Cotypes.—Cat. No. 52594, U.S.N.M.

ONCOUSOECIA ACCUMULATA, new species.

Plate 1, figs. 2–5.

Description.—The zoarium is formed of discoid subcolonies *accumulated* upon each other; it is irregularly cylindrical and narrowed laterally from place to place. The tubes are cylindrical (?), recurved toward the periphery, restricted to each subcolony; the peristome is thin, salient, sharp. The ovicell is globular, elliptical, transverse, and aborts the adjacent tubes; the oeciostome is an ordinary peristome, little salient and placed somewhat eccentrically.

Structure.—The structure of this species is quite remarkable. Externally it resembles somewhat *Spiropora*, but the windings of the spire are in reality only the discoid subcolonies piled on top of each other. Each of them appears to grow from the center of the inferior subcolony. Nevertheless the calcification of the tubes may not be produced very regularly, for often there are tubes which pass across the superior subcolonies. Our specimens are not numerous enough to prepare sufficient thin sections to thoroughly understand this species, so that its structure still remains doubtful. They had been identified as *Ceriopora radiciformis* Goldfuss, 1827[2] but they are certainly quite different from Goldfuss's figures 8*a–c*, although it is possible that his figures 8*d*, *e* represent the present species.

Occurrence.—Jurassic: Birmenstorf, etc., Germany.

Cotypes.—Cat. No. 32195, U.S.N.M.

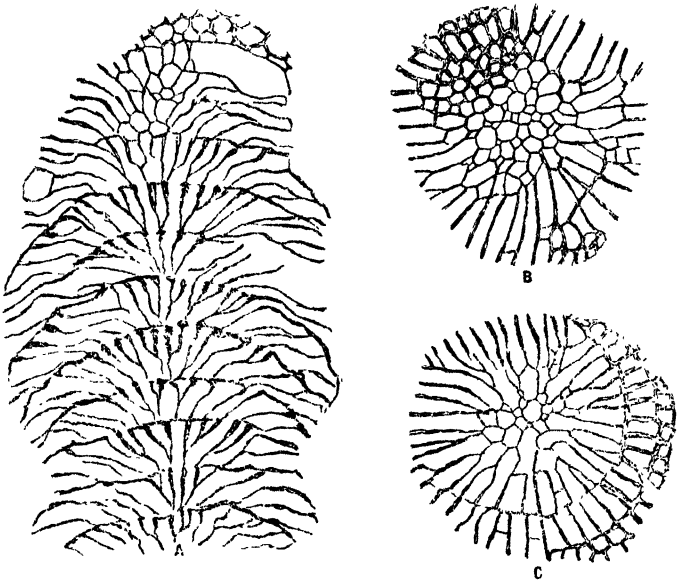


FIG. 1.—Oncousoecia accumulata, new species.

A. Longitudinal section, × 12, showing the accumulation of the subcolonies. An ovicell is visible near the top.

B. Transverse section, × 12, through one of the constricted parts of the zoarium.

C. Transverse section, × 12, through a dilated portion.

Jurassic of Germany.

Family MACROECIIDAE Canu, 1918.

1918. *Macroeciidae* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 16, p. 328.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 722.

The longitudinal axis of the ovicell is parallel to the axis of the tubes whose order and arrangement are disarranged. The oeciostome is immense and terminal.

---

[2] Petrefacta Germanicae, p. 34, pl. 10, figs. 8*a–e*.

This family is characterized by the size of its larva which, although unknown, is established by the unusual size of the oeciostome. Although similar to the Oncousoeciidae in the arrangement of the ovicell parallel with the tubes, it differs in its formation before the calcification of the near-by tubes.

Genus MACROECIA Canu, 1918.

1918. *Macroccia* Canu, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 16, p. 328.—1920. Canu and Bassler, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 722.

The ovicell is elongate, elliptical, very salient. The oeciostome is not turned toward the bottom.

Genotype.—*Macroecia* (*Diastopora*) *lamellosa* Michelin, 1846, Jurassic.

MACROECIA LAMELLOSA Michelin, 1846.

1896. *Diastopora lamellosa* Gregory, Catalogue of the Jurassic Bryozoa in the British Museum, p. 126, fig. 35 (p. 17) pl. 7, fig. 3 (bibliography and geologic distribution).

1920. *Macroecia lamellosa* Canu and Bassler, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 723, fig. 235*A–D*, *F–I* (Not fig. 235 *E* or 227 *H*=*Atractosoecia edwardsi* Canu, 1913).

The structure of this species is still little understood. In longitudinal sections the tubes are short, enlarged at the middle, with thick walls; the gemmation is triparietal on the zooecia of the opposite pseudolamella. In transverse section there is no basal lamella. The tubes are polygonal, with thick walls, nonsymmetrically arranged on each side of the median axis.

This structure in this species is remarkable and quite unexpected. The fronds are not formed by lamellae approaching each other or by the tubes developing from each side of a median lamella, but it is a foliaceous structure. The tubes are not at the same height in the transverse section and on the two zoarial faces; each tube of one side serves as a support to a more elevated tube on the other side.

Gregory in 1896 has published a longitudinal section of a multilamellar specimen. This same structure is here apparent; moreover the exterior lamellae appear to have a basal lamella. The transverse section in an analogous specimen figured by Haime, 1854, indicates a median lamella. These two sections need confirmation, for they do not seem to correspond. However, the dissymetrical character of the sections is clearly apparent.

Canu and Bassler in 1920 as noted in the synonymy above, included a figure of *Atractosoecia edwardsi* Canu, 1913, in their illustrations of this species. Further studies are still necessary upon this interesting Jurassic bryozoan.

Occurrence.—Jurassic (Bathonian): Ranville, etc. (Calvados), and Occaignes (Orne), France.

Plesiotypes.—Cat. No. 68900, U.S.N.M.

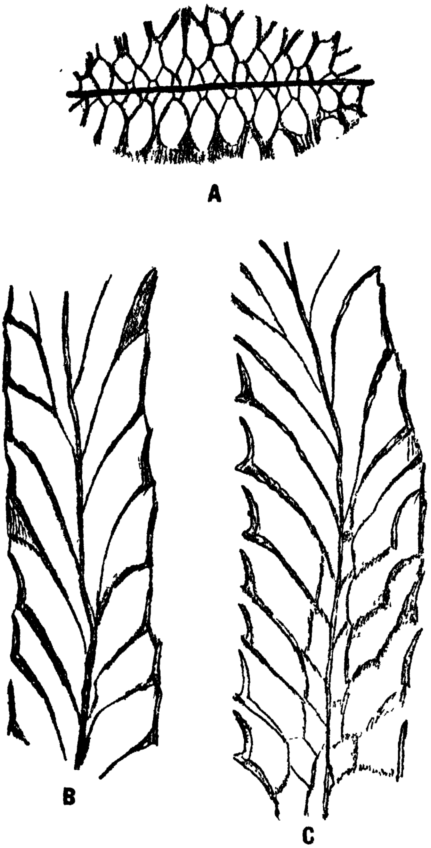


FIG. 2.—Macroecia lamellosa Michelin, 1846.

A. Transverse thin section, × 16, of a thick, much calcified frond. The two basal lamellae are united together to form a unique median lamella.

B. Longitudinal section, × 16, illustrating that the two lamellae are not symmetrically placed.

C. A longitudinal section, × 16, showing that all the zoaria of a lamella are not oriented alike.

Jurassic (Bathonian): Ranville (Calvados), France.

ATRACTOSOECIA, new genus.

Greek: *Atractos*, spindle, in allusion to the form of the ovicell.

The ovicell is a very long fusiform sack; the oeciostome is terminal, elliptical, transverse, larger than the other peristomes. The tubes are cylindrical.

Genotype.—*Atractosoecia* (*Berenicea*) *edwardsi* Canu, 1913. Bathonian. In 1920 we classed the genotype in *Macroecia*, but the discovery of a new species having an identical ovicell made it advisable to create this new genus in which the form of the ovicell is very constant and different from that of *Macroecia lamellosa* Michelin, 1846.

ATRACTOSOECIA WALFORDIANA, new species.

Plate 4, fig. 8.

Description.—The zoarium encrusts shells forming expansions of some width. The tubes are distinct, separated by a furrow, somewhat convex, cylindrical; the peristomes are salient, thin, orbicular, arranged in quincunx. The ovicell is very long, fusiform, smooth; the oeciostome is terminal, salient, elliptical, transverse, a little larger than an ordinary peristome.

Measurements.-	Diameter of peristome	0.12 mm.
	Diameter of orifice	.09 mm.
	Distance of tubes	.50 mm.
	Separation of tubes	.40 mm.
	Length of ovicell	1.20 mm.
	Width of ovicell	.40 mm.

Affinities.—This fine species is named in honor of Mr. Edwin A. Walford, of Banbury, England, in appreciation of his excellent studies upon the Jurassic faunas. It differs from *Atractosoecia edwardsi* Canu, 1913, in its smaller micrometric dimensions and in the relatively more elongated ovicell.

Occurrence.—Jurassic (Bathonian): Shipton Gorge, Dorset, England.

Holotype.—Cat. No. 68901, U.S.N.M.

ATRACTOSOECIA EDWARDSI Canu, 1913.

Plate 4, fig. 7.

1913. *Berenicea edwardsi* CANU, Contributions à l'étude des Bryozoaires fossiles, XIII, Bulletin Société Geologique de France, ser. 4, vol. 13, p. 270 (bibliography and geologic distribution).

This species has been confused for a long time with *Trigonoecia* (*Berenicea*) *diluviana* Lamouroux, 1821, but Canu in 1913 revised the bibliography of the two species. Although the ovicell was known since 1852, for D'Orbigny figured it, we believe it useful to give a new photograph for comparative purposes. The ovicell is very long, sack shaped, oval, very narrow at the base, convex, transversely striated. The oeciostome is orbicular, salient, much larger than an ordinary peristome, and opening in a different direction from that of the tubes.

Measurements.—	Diameter of peristome	0.16 mm.
	Diameter of orifice	.14 mm.
	Diameter of tubes	.24 mm.
	Distance of tubes	.64–0.80 mm.
	Separation of tubes	.56–0.64 mm.
	Length of ovicell	3.30 mm.
	Width of ovicell	1.60 mm.

In our North American Early Tertiary Bryozoa the figure[3] of this species was inadvertently labeled *Macroecia lamellosa* Michelin, 1845.

Occurrence.—Jurassic (Bathonian): Ranville, Luc sur Mer, etc. (Calvados), France.

Family MECYNOECIIDAE Canu, 1918.

1918 *Mecynoeciidae* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société geologique de France, ser. 4, vol. 16, p. 326.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 722.

The ovicell is developed parallel to the tubes. It is formed before them and disarranges their respective positions. The oeciostome is anterior and nonterminal.

The genera now referred to this family are *Mecynoecia* Canu, 1918, *Trigonoecia*, new genus, *Cardioecia*, new genus, *Nematifera*, new genus, *Microecia* Canu, 1918, *Exochoecia* Canu and Bassler, 1920, *Brachysoecia*, new genus, and *Bisidmonea* D'Orbigny, 1852.

Genus MECYNOECIA Canu, 1918.

1918. *Mecynoecia* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 16, p. 326.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 722.

The ovicell developed parallel to the tubes, is symmetrical and with indefinite outlines. The oeciostome is elliptical, transverse, turned toward the base, generally supported by a tube.

Genotype.—*Mecynoecia* (*Entalophora*) *delicatula* Busk, 1875.

The wide-spread and abundant species *Entalophora proboscidea* Milne-Edwards, 1836, was cited as the type of the genus by Canu in 1918, but we have changed the genotype for the reason that several species with different kinds of ovicells are undoubtedly included under this name and it is perhaps impossible at present to determine which one Milne-Edwards described.

---

[3] Bull. 106, U. S. National Museum, p. 689, fig. 227 *H*, and p 723, fig. 235 *E*.

Various forms of growth are represented in the species with the ovicell of *Mecynoecia*, but the majority have the *Entalophora* zoarial form—that is, an erect ramose growth with the zooecial tubes opening on all sides. Other species of *Entalophora*, however, have ovicells characteristic of two other families, and still others show no ovicell at all. The ovicell of the genotype of *Entalophora*, *E. cellarioides* Lamouroux, 1821, is unknown, so, following our custom, we retain the name *Entalophora* as a zoarial form for species showing no ovicell.

MECYNOECIA GRACILIS, new species.

Plate 4, fig. 4.

Description.—The zoarium is free, unilamellar; the zone of growth is thin and narrow. The tubes are distinct, separated by a small furrow, somewhat convex, *slender*, terminated by a rather long peristomie; the aperture is elliptical, or orbicular; the peristomes are thin, little separated from each other. The ovicell is small, elongated, convex, smooth; the oeciostome is somewhat smaller than a peristome.

Measurements.—	Diameter of aperture	0.08– .10 mm.
	Diameter of peristome (=zooecial)	.16 mm.
	Distance of peristomes	.64– .80 mm.
	Separation of peristomes	.56 mm.

Affinities.—In the general aspect of its tubes this species resembles *Trigonoecia verrucosa* Milne Edwards, 1838, but it differs in its smaller micrometric measurements, in its free zoarium, and in the form of its ovicell.

We owe the figured specimen to the kindness of Mr. Edwin A. Walford of Banbury, England.

Occurrence.—Jurassic (Bathonian): Shipton Gorge, Dorset, England.

Holotype.—Cat. No. 68902, U.S.N.M.

MECYNOECIA OBESA, new species.

Plate 1, figs. 6–8.

Description.—The zoarium has the cylindrical, branching *Entalophora* form of growth enlarged at the bifurcations. The tubes are thin, long, cylindrical, regular, convex, striated transversally, terminated at their extremity by a peristomie somewhat upward bent and very salient. The oeciostome is thin, orbicular, oblique. The ovicell is *enormous*, very globular, elongate, elliptical, striated transversally by large wrinkles; the oeciostome is transverse, elliptical, orthogonal, somewhat wider than the tubes.

Measurements.—	Diameter of tube and of peristome	0.14 mm.
	Distance between orifices	0.58–1.00 mm.
	Separation of peristomes	.66 mm.

Affinities.—The exterior aspect is absolutely that of *Entalophora delicatula* Busk, 1875, but the present species differs not only in the form of the ovicell, but in its larger micrometric dimensions.

Occurrence.—Recent; Sulade (Sulu Archipelago), Philippine Islands (*Albatross* station D. 5147).

Cotypes.—Cat. No. 7373, U.S.N.M.

MECYNOECIA LONGIPORA MacGillivray, 1895.

Plate 1, figs. 9–11.

1895. *Entalophora longipora* MACGILLIVRAY, A Monograph of the Tertiary Polyzoa of Victoria, Transactions of the Royal Society of Victoria, vol. 4, p. 140, pl. 20, fig. 14.

Measurements.—	Oeciostome	.16–.20 by .12 mm.
	Distance between orifices	1.25–1.42 mm.
	Diameter of peristome and of tube	.16 mm.
	Separation of orifices	.80– .90 mm.

Structure.—The ovicell is placed in the vicinity of a bifurcation. It is elongated, elliptical, salient, very finely porous. The oeciostome is terminal, elliptical, transverse, little salient; the oeciopore is parallel to the meridian zoarial plane.[4]

The tubes are slightly convex, often flat and bordered by a somewhat salient thread. The latter character is not indicated on MacGillivray's figure, but it is described in the text.

The scale of magnification of MacGillivray's figures is not good, and we can not be perfectly certain of our determination in the absence of typical specimens.

Occurrence.—Recent; Anima Sola (between Burias and Luzon) Philippine Islands (*Albatross* Station D. 5217).

Geological distribution.—Miocene of Australia.

Plesiotypes.—Cat. No. 7374, U.S.N.M.

MECYNOECIA (?) VERTICILLATA Goldfuss, 1827.

Plate 1, figs. 16, 17.

1827. *Ceriopora verticillata* GOLDFUSS, Petrefacta Germaniae, vol. 1, p. 36, pl. 11, fig. 1.

1899. *Spiropora verticillata* GREGORY, Catalogue of the fossil Bryozoa in the British Museum, Cretaceous, vol. 1, p. 256, pl. 11, fig. 5 (Cites bibliography and geologic distribution).

The ovicell of this species is very rare. It is a greatly elongated, convex sac, longer than three verticells and terminated by an elliptical, transverse, reflected oeciostome. It results from the development of the peristomie of a tube belonging to a verticell. The species is therefore a *Mecynoecia.*

---

[4] Often the oeciostome appears to be directed toward the bottom, but this is an optical illusion. In reality the orifice is exactly parallel to the direction of the tube itself and the oeciostome is perpendicular to it. It is therefore difficult for the larva to fasten itself upon the zoarium. The term "orthogonal" indicates this arrangement.

Waters long ago expressed his doubts about the reality of the genus *Spiropora* Lamouroux, 1821. The discovery of the ovicell confirms his opinion, since the genus *Mecynoecia* contains a number of species with the zoarial form of both *Entalophora* and *Spiropora.* Nevertheless as this species and two or three others show in transverse section a spiral arrangement of the tubes, it is possible that Lamouroux's genus may still be retained.

Occurrence.—Cretaceous (Coniacian): Villedieu (Loir-et-Cher). France, and many other localities and horizons.

Plesiotypes.—Cat. No. 68905, U.S.N.M.

MECYNOECIA RAMOSISSIMA D'Orbigny, 1851.

Plate 1, figs. 12, 13.

1845. *Pustulopora echinata* MICHELIN (not Roemer), Iconographie zoophytologique, p. 211, pl. 53, fig. 5.

1851. *Entalophora vendinnensis* D'ORBIGNY, Paleontologie française. Terrain Crétacé, p. 871, pl. 617, figs. 15–17.

1851. *Entalophora ramosissima* D'ORBIGNY, Paleontologie française, Terrain Crétacé, pl. 619, figs. 6–9.

1851. *Laterotubigera cenomana* D'ORBIGNY, Paleontologie française, Terrain Crétacé, p. 785, pl. 618, figs. 1–5.

1899. *Entalophora vendinnensis* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 241 (not Canu 1897-*Mecynoecia stipata,* new species).

1899. *Entalophora ramosissima* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 244.

Measurements.—	Diameter of peristome	0.14–0.18 mm.
	Zooecial width	.24 mm.
	Distance between orifices	.30 – .50 mm.
	Separation of orifices	.60 mm.

Variations.—Gregory has reported this species under three distinct names, the material in the British Museum appearing insufficient to determine the variations. In 1889 Pergens had not united *Entalophora vendinnensis* with *Entalophora ramosissima,* for he still gave more importance to the exterior aspect. In 1897, Canu, deceived by the aspect of a related species, maintained the same differences, but his *Entalophora vendinnensis* is a different species (see *M. stipata*) on account of its different measurements and ovicell.

In comparing numerous specimens in the Canu collection it is not possible to maintain the former distinctions; there is but a single species with varied aspects in which however the ovicell is the same. It is not rare to find on a single specimen the two forms *Entalophora* with the tubes in quincunx and *Laterotubigera* having tubes in transverse verticells.

The ovicell is short, elliptical, somewhat elongate and cordiform. The oeciostome is transverse, elliptical, turned toward the bottom; it is isolated or adherent to a tube; it is anterior and not terminal with the ovicell prolonged a little above it.

The verticelled specimens are the lowest branches of the zoarium; they are larger and almost always poorly preserved and broken. The specimens referred to *E. vendinnensis*, are the upper branches. The number of branches of a zoarium must be very considerable: we are still ignorant of the form of the base and mode of fixation.

In transverse section the tubes are polygonal, very small and very numerous at the center, large at the circumference, all indicative of very long tubes.

In longitudinal section the tubes are very long, quite thin at the base, and much expanded at their extremity. The walls increase gradually in thickness.

Geologic distribution.—Cretaceous (Cenomanian): Le Mans (Sarthe), France.

Cretaceous (Turonian): St. Calais, Les Janières, and Ruillé Poncé (Sarthe), France.

Plesiotypes.—Cat. No. 68906, U.S.N.M.

MECYNOECIA STIPATA, new species.

Plate 1, figs. 14, 15.

1897. *Entalophora vendinnensis* Canu (not D'Orbigny, 1851), Les Bryozoaires du Turonien des Janières, Bulletin Société Géologique France, ser. 3, vol. 25, p. 152.

1897. *Entalophora vendinnensis* Canu, Les Bryozoaires du Turonien de St. Calais, Bulletin Société Géologique de France, ser. 3, vol. 25, p. 744.

Description.—The zoarium is cylindrical, bifurcated. The tubes are little distinct, upward bent and salient at their extremities, arranged in quincunx, quite *close* to one another; the peristome is round and thin. The ovicell is elliptical, elongate, globular; the oeciostome is as wide as a tube, elliptical, transverse, isolated, turned toward the bottom.

Measurements.—	Diameter of peristome	0.14 mm.
	Zooecial width	.24 mm.
	Distance between orifices	.36 mm.
	Separation of the orifices	.60 mm.
	Diameter of branches	1.00–1.50 mm.

Affinities.—This species is quite constant in its exterior characters; only the peristomie is more or less long. It differs from *Mecynoecia ramosissima* D'Orbigny, 1851, in its larger micrometric dimensions, its more globular and more salient ovicell and its almost terminal oeciostome. Rare and slender in the Cenomanian, it is vigorous and abundant in the Turonian.

Geological distribution.—Cretaceous (Cenomanian): Le Mans (Sarthe), Montlouet (Maine-et-Loire), France.

Cretaceous (Turonian): Les Janières and St. Calais (Sarthe), Ruillé Poncé (Loir-et-Cher) and Parnay (Indre-et-Loire), France.

Cotypes.—Canu collection and Cat. No. 68907, U.S.N.M.

MECYNOECIA MICROPORA D'Orbigny, 1853.

Plate 2, fig. 1.

1853. *Laterotubigera micropora* D'ORBIGNY, Paleontologie française, Terrain Crétacé, p. 719, pl. 754, figs. 12–14.

1889. *Spiropora macropora* var. *micropora* PERGENS, Revision des Bryozoaires du Crétacé figures par D'Orbigny, Memoirs de la Société Belge de Géologie de Paléontologie et d'Hydrologie, Bruxelles, vol. 3, p. 365.

1890. *Spiropora macropora* var. *micropora* PERGENS, Nouveaux bryozoaires Cyclostomes du Crétacé, Bulletin de la Société Belge de Géologie, vol. 4, Mémoires, p. 205.

Affinities.—In 1890 Pergens identified *Laterotubigera micropora* D'Orbigny, 1853, with *Semilaterotubigera annulata* of the same author. This was an error which was occasioned by the the great confusion which existed in the tubes of specimens in D'Orbigny's collection and the poor illustrations of the French author. Consideration of the ovicells permits us to clear up this confusion.

The peristome is orbicular (and not transverse); it measures only 0.14 mm. in dimension (and never 0.18 or 0.20 mm.). The transversal diameter is only 0.20 mm. (and not 0.26 mm.). The ovicell is an elongated and quite large sac, of which unfortunately we have not observed the oeciostome.

This is the smallest of the species in which the tubes are grouped in transversal rows.

Geological distribution.—Crétaceous (Coniacian) Villedieu (Loir-et-Cher), Tours and St. Paterne (Indre-et-Loire), and Fécamp (Seine inferieure), France.

Plesiotypes.—Cat. No. 68908, U.S.N.M.

MECYNOECIA (?) ANNULOSA Michelin, 1847.

Plate 2, fig. 2–10.

1896. *Spiropora annulosa* GREGORY, Catalogue Jurassic Bryozoa in British Museum, p. 146, pl. 8, fig. 5 (Bibliography).

1898. *Spiropora annulosa* CANU, Étude sur les ovicelles des Bryozoaires du Bathonian d'Occaignes, Bulletin de la Société géologique de France ser. 3, No. 26, p. 281, figs. 16, 17, 18, 19, 20.

1914. *Entalophora* (*Spiropora*) *annulosa* WATERS, The marine fauna of British East Africa and Zanzibar, Proceedings of the Zoological Society of London, p. 842.

In 1898, Canu gave the principal variations of the ovicell, which is sacciform (fig. 3), cordiform (fig. 4), or pyriform (fig. 5). Unfortunately his figures only represent specimens with peristomes arranged in quincunx. In 1914 Waters, in verifying the species, wrote: "Canu does not figure the spiral zooecia or regular, therefore, why does he call it *Spiropora*"? and he made the generic correction indicated in our bibliography.

In reality this species affects the two forms, *Entalophora* and *Spiropora*, and the two arrangements of the peristomes are often visible on the same specimens (fig. 7). There is, therefore, no error in the determination. The identity of the ovicell of a branch with verticells (fig. 6) with that of a branch without verticells (fig. 5) is another very convincing proof. The most extraordinary variations affect also the diameter of the peristome, which varies from 0.14 (fig. 8) to 0.20 (fig. 9). Thus detailed study of this species confirms the perfect uselessness of the two supposed genera *Entalophora* and *Spiropora*, based on the arrangement of the peristomes.

Occurrence.—Jurassic (Bathonian): Occaignes (Orne), France.

Plesiotype.—Cat. No. 68910, U.S.N.M.

MECYNOECIA VARIABILIS Hagenow, 1851.

Plate 2, fig. 14.

1851 *Pustulopora variabilis* HAGENOW. Die Bryozoen der Maastrichter Kreidebildung, p. 19, pl. 1, fig. 9.

We have found a fragment of this species bearing an ovicell which shows that, without doubt, it is a *Mecynoecia.* Our photograph is quite similar to Hagenow's figure, and we do not understand how Gregory, in 1899, could class the species in *Clausa.* The section, which he illustrates, must certainly have been made from a badly determined specimen. Pergens, in 1888, classed the species with certainty in *Entalophora.*

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland.

Plesiotype.—Cat. No. 68910, U.S.NM..

TRIGONOECIA, new genus.

The ovicell is pyriform, symmetrical, convex, wrinkled transversely. The oeciostome is small, salient, terminal, median, on the same plane as the ordinary peristomes. The tubes are cylindrical, with triparietal gemmation on a basal lamella.

Genotype.—*Trigonoecia* (*Mesenteripora*) *michelini* Blainville, 1830.

Range.—Jurassic (Bajocian-Albian).

TRIGONOECIA MICHELINI Blainville, 1830.

Plate 2, figs. 12, 13.

1896. *Diastopora michelini* GREGORY, Catalogue of the Jurassic Bryozoa in the British Museum, p. 124, pl. 7, fig. 2 (cites bibliography and geologic distribution).

1898. *Diastopora michelini* CANU, Études sur les ovicelles des Bryozoaires du Bathonien d'Occaignes, Bulletin Société geologique de France, ser. 3, vol. 26, p. 277, figs. 10, 11.

Measurements.—	Diameter of aperture	0.13– 0.14 (max.=0.17) mm.
	Diameter of peristome	0.17– .21 mm.
	Diameter of zooecium	.21– .28 mm.
	Distance of peristomes	.75– .85 mm.

Structure.—In longitudinal section the tubes are rather short, cylindrical, with triparietal gemmation on a median lamella (=basal); their inferior part is narrowed according to the rule in this case.

In transverse section the tubes are polygonal with thin adjacent walls. As the greater part of the fronds are undulated, the median lamella is never rectilinear and one side is always thicker than the other. The tubes adjacent to the median lamella are smaller than the others because they represent the inferior part of the tubes.

It will be observed in the present article that all the Diastoporas of the older authors have not this structure and that their ovicells are not at all identical. *Diastopora* is only a zoarial form and by no means a natural genus.

Occurrence.—Jurassic (Bathonian and Bajocian): Ranville (Calvados), Occaignes (Orne), etc., France.

Plesiotype.—Cat. No. 68911, U.S.N.M.

TRIGONOECIA VERRUCOSA Milne Edwards, 1838.

Plate 4, fig. 5.

1898. *Diastopora verrucosa* CANU, Etude sur les ovicelles des Bryozoaires du Bathonien d'Occaignes, Bulletin Société geologique de France ser. 3, vol. 26, p. 269 (bibliography).

Measurements.—	Diameter of aperture	0.14 mm.
	Zooecial diameter	.20 mm.
	Distance between peristomes	.60 mm.
	Separation of peristomes	.70 mm.

Structure.—The measurements are a little different from those of Canu, 1898, but they are close enough. In the *Berenicea* growth forms it is impossible to obtain measurements in absolute agreement.

The ovicell is globular, triangular, transverse, wrinkled transversely. The oeciostome is very long (0.16 mm.); it is supported on an ordinary tube. Its diameter is small (0.10 mm.), and its orifice measures 0.06 mm., as in all the species of this genus.

We are indebted to Mr. Edwin A. Walford for the figured specimen.

Occurrence.—Jurassic (Bathonian): Shipton Gorge, Dorset, England.

Plesiotype.—Cat. No. 68912, U.S.N.M.

TRIGONOECIA TRANSVERSA, new species.

Plate 4, figs. 1, 2.

Description.—The zoarium encrusts shells; it is orbicular; the zone of growth is narrow but thick. The tubes are visible, quite convex, very salient, rectilinear, cylindrical. The peristomes are orbicular, oblique, thin, very close together but never adjacent. The ovicell is triangular, transverse, convex, decorated with two transverse salient wrinkles; the oeciostome is orbicular, little salient, opening on the same plane as that of the peristomes.

Measurements.—	Diameter of orifice	0.12 mm.
	Diamter of peristome	0.16–0.18 mm.
	Distance between tubes	.40– .48 mm.
	Separation of tubes	.64– .72 mm.
	Diameter of oeciostome	0.07 mm.
	Diameter of zoarium	6.00 mm.

Affinities.—This beautiful species which has been discovered by Mr. Walford in the English Bathonian has external resemblances to *Trigonoecia* (*Berenicea*) *verrucosa* Milne Edwards, 1838, in which the tubes are equally rectilinear; it differs in its peristomes which are much closer together and in the thickness of the marginal borders. It differs from *Berenicea exilis* Reuss, 1867, in the regular arrangement of its peristomes and in its smaller micrometric measurements.

The regular and very symmetrical form of the ovicell does not permit of confusion with that of *Plagioecia.*

Occurrence.—Jurassic (Bathonian): Shipton Gorge, Dorset, England.

Holotype.—Cat. No. 68913, U.S.N.M.

CARDIOECIA, new genus.

The ovicell is triangular, transverse, cordiform, little convex, smooth, symmetrical; the oeciostome is small, salient, median. The tubes are club shaped with triparietal gemmation on a basal lamella.

Genotype.—*Cardioecia* (*Bidiastopora*) *neocomiensis* D'Orbigny, 1853. Lower Cretaceous (Neocomian, Aptian).

The ovicell is less salient and more expanded than in *Trigonoecia.*

The tubes are larger and club shaped. The latter character is clearly visible in transverse sections which show a large number of tubes increasing regularly from the center to the circumference.

We have observed only the free forms of growth, but encrusting forms are quite possible.

The oeciostome always measures 0.10 mm. and the oeciopore 0.06 mm. No exceptions to this have been found. The genotype *Bidiastopora neocomiensis* D'Orbigny, 1852 (pl. 4, fig. 3), from the Lower Cretaceous (Valangian) of Switzerland will be described in our next paper.

NEMATIFERA, new genus.

The ovicell is an elongated sack, subsymmetrical, irregular, scarcely convex; the oeciostome is terminal, very small, hardly salient. All of the tubes are bordered with salient threads exteriorly. The tubes are short, cylindrical, polygonal; the gemmation is triparietal on a basal lamella.

Genotype.—Nematifera (*Elea*) *reticulata* D'Orbigny, 1853. Lower Cretaceous (Neocomian, Urgonian).

The ovicells so far discovered are little distinct, but clearly different from those of *Trigonoecia*, although the structure in sections in these two genera is very similar. The tubes are bordered exteriorly by a salient thread, which never occurs in *Trigonoecia*.

According to the exterior resemblances, this genus ought to have Jurassic representatives. The genotype (pl. 4, fig. 6) is described in detail in our paper on the Lower Cretaceous faunas of Switzerland now in preparation.

ENTALOPHORA (NEMATIFERA?) ROEMERI Levinsen, 1912.

Plate 13, figs. 11–13.

1840. *Melicerittites gracilis* ROEMER, Die Versteinerungen des norddeutschen Kreidegebirges, p. 18, pl. 5, fig. 13.

1912. *Entalophora roemeri* LEVINSEN, Studies on the Cyclostomata operculata, Memoires de l' Academie R. des Science et des Lettres de Danemark, ser. 7, vol. 10, p. 29, pl. 7, figs. 25, 26.

Levinsen's original description is as follows:

The hexagonal zooecia, which are only half as long as broad, are provided with a very concave frontal area and divided by strongly developed marginal ridges. The aperture which takes up the larger part of the breadth in the distal part of the zooecium, and together with the peristome about half the length of the whole zooecium, is triangularly rounded, broader than high, and provided with a strongly developed peristomial thickening, the proximal part of which forms an obliquely or even vertically ascending under lip. The fragments examined are elongated clavate, rounded or a little compressed and increasing gradually in thickness toward the lip, which is about double as thick as the proximal end.

Like Levinsen, we have found our specimen in a lot of *Meliceritites gracilis* Goldfuss, 1827. It appears to us more poorly preserved than Levinsen's example, but as it preserves a kind of eleocellarium we figure it. On the greater part of the zoarium the peristome is much thinner than that figured by Levinsen.

Occurrence.—Cretaceous (Cenomanian): Essen, Germany.

Plesiotype.—Cat. No. 68914, U.S.N.M.

Genus MICROECIA Canu, 1918.

1918. *Microecia* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Géologique de France, ser. 4, vol. 16, p. 326.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 722.

The ovicell is very small, and it is spread between only four tubes; the oeciostome is small and hardly salient.

Genotype.—*Berenicea sarniensis* Norman, 1864.

MICROECIA DENISI, new species.

Plate 2, fig. 11.

Description.—The zoarium is cylindrical, bifurcated. The tubes are indistinct; the peristomes are thin, orbicular, arranged in regular quincunx, little salient. The ovicell is small, somewhat elongate, nonsalient, finely punctate, the oeciostome is quite small, terminal, nonsalient, placed in the vicinity of the peristome.

Measurements.—	Diameter of peristome	0.18–0.20 mm.
	Distance between orifices	0. 40 mm.
	Separation of orifices	.80–1.00 mm.
	Diameter of branches	2. 5 mm.

Affinities.—The micrometric measurements of this species are much larger than those of *Mecynoecia stipata* and *Mecynoecia ramosissima* D'Orbigny, 1851. Its ovicell is of a very different type. It is smaller than a tube, turned toward the bottom, perforated at its base by a sort of spiramen.

It is important to note the amount of the separation of the orifices. More often the distance between the orifices and the separation are very similar. Here, on the contrary, they are quite different.

We dedicate this species to the young French naturalist, Marcel Denis, to encourage him in the study of the bryozoa.

Geological distribution.—Cretaceous (Turonian): Ruillé-Poncé (Loir-et-Cher), France.

Holotype.—Canu collection.

BRACHYSOECIA, new genus.

Greek.—Brachys, short, in allusion to the slight length of the ovicell.

The ovicell is longitudinal, very short. The oeciostome is transverse, reflexed, adjacent to a tube and of a smaller diameter than the peristome. The tubes are expanded with walls somewhat dilated at their extremity. Gemmation is peripheral, regular, around an axial tube. The tubes are closed by a facette (zooecial area) perforated by an orbicular aperture.

Genotype.—Brachysoecia convexa, new species. Cenomanian.

This genus differs from *Microecia* Canu, 1916, in the presence of facettes. It differs from *Lobosoecia*, new genus in which the aperture is also rounded, in the nature of the ovicell and in the absence of salient threads around the facette.

BRACHYSOECIA CONVEXA, new species.

Plate 3, figs. 1–5.

Description.—The zoarium is free, cylindrical, dichotomously branched, borne on a discoid base. The facettes are hexagonal, elongated, separated by a furrow of little depth. The aperture is circular, distal, bordered by a thin salient thread. In section, the tubes are expanded (=funnel-shaped), with walls somewhat dilated at their extremity; gemmation is peripheral, regular, around an axial tube. On the zone of growth the tubes are deprived of facettes. The ovicell is short; the oeciostome is smaller than a peristome, transverse, adjacent to a tube.

Measurements.—	Diameter of branch	1.5 mm.
	Zooecial diameter	.13–0.16 mm.
	Distance between apertures	.40– .50 mm.

Structure.—The structure of this species is rather unexpected. The facettes not being bordered as in *Melicertites*, it was difficult to discover them on the exterior. However they appear clearly in longitudinal sections where also the expanded form of the tubes, their mode of peripheral gemmation and the presence of the axial tube are apparent. The occurrence of an axial tube seems to indicate the existence of other, although lamellar, species. In the transverse sections this tube appears clearly at the center of the zoarium in the form of a polygonal tube larger than the adjacent ones.

The occurrence of tubes with facettes is to be noted also in the following families characterized, however, by different ovicells; Melicerititidae and Lobosoeciidae with bordered facettes, Plagioeciidae with incomplete or rudimentary facettes and the Mecynoeciidae with the facettes not bordered.

Occurrence.—Cretaceous (Cenomanian); Le Mans (Sarthe), France.

Cotypes.—Canu collection and Cat. No. 68915, U.S.N.M.

Genus BISIDMONEA D'Orbigny, 1852.

1852. *Bisidmonea* D'ORBIGNY, Paleontologie francaise, Terrain Crétacé, vol. 5, p. 720.

The ovicell is a long convex sack located on the zoarial crest and deranging all the adjacent tubes; the oeciostome is terminal, placed on the median axis, somewhat salient, not reflexed, of the size of an ordinary peristome, somewhat transverse. The tubes are arranged in irregular fascicles, much expanded, with method of gemmation doubtful, closed by a zooecial area (metopoporinan) which is perforated by the orbicular aperture.

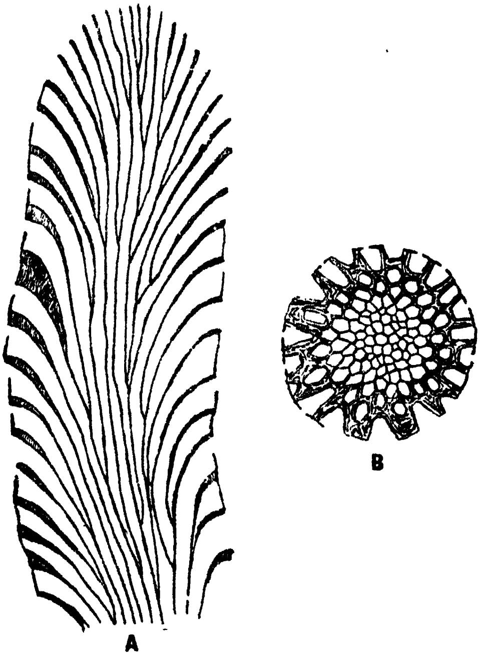


FIG. 3.—Brachysoecia convexa, new species.

A. Longitudinal section, × 16, showing the axial tube, the zooecial apertures and facette.

B. The same features as seen in a transverse section, × 16.

Cretaceous (Cenomanian): Le Mans (Sarthe), France.

Genotype.—*Bisidmonea antiqua* D'Orbigny, 1852 (=*Spiropora tetragona* Lamouroux, 1821). Bathonian.

Historical.—The character upon which this genus was formed by D'Orbigny was the special arrangement and the alternation of the rows of tubes on tetragonal zoaria. The general aspect is that of two specimens of *Idmonea* united together by their dorsal. Haime in 1854 and Gregory in 1896 have established that the genotype *B.*

antiqua D'Orbigny, 1852 is synonymous with *Spiropora tetragona* Lamouroux, 1821. Finally Gregory in 1896 noted that the idmoneiform arrangement of the apertures is not constant throughout the whole zoarium.

The consideration of the ovicell causes the classification of this genus in the Mecynoeciidae. Examination of thin sections which shows the very unexpected metopoporinan nature of the tubes, permits us to maintain D'Orbigny's name but with a very different diagnosis. According to the section, *Spiropora richmondensis* Vine, 1884, belongs probably to this genus. We may here again note that the exterior aspect and the arrangement of the tubes of the zoarium can not furnish important characters for classification. For example, *Bisidmonea gabbiana* Ulrich and Bassler, 1904, and *B. johnstruppi* Pergens and Meunier belongs to the Plagioeciidae, the type species *B. tetragona* Lamouroux, 1821, to the Mecynoeciidae and *B. ? globuloecia*, new species to still another family.

BISIDMONEA TETRAGONA Lamouroux, 1821.

Plate 3, fig. 6.

1821. *Spiropora tetragona* LAMOUROUX, Exposition methodique, p. 85, pl. 82, figs. 9, 10.

1846. *Ceriopora tetragona* MICHELIN, Iconographie zoophytologique, p. 235, pl. 55, fig. 12.

1852. *Bisidmonea antiqua* D'ORBIGNY, Paleontologie francaise, Terrain Crétacé, p. 720, pl. 762, figs. 10–12.

1896. *Spiropora tetragona* GREGORY, Catalogue of the Jurassic Bryozoa in the British Museum, p. 155, pl. 9, figs. 1 (Cites bibliography and geological distribution).

Structure.—The zoarial aspect is that of two specimens of *Idmonea* joined by their dorsal but longitudinal sections show a very different structure from typical *Idmonea.* The tubes are subcylindrical in a part of their course, but they become very much expanded in their terminal portion; their walls are vesicular and they are closed by a facette (zooecial area) clearly limited exteriorily by salient threads. We may mention again that the tubes with facettes, for which the group Metopoporina was proposed, exist in almost all families of Cyclostomata.

Our specimens are small, and we have not been able to verify the method of budding. As the transverse section shows at its center very large tubes without interstitial tubes, peripheral gemmation is not probable. The entire absence of the median lamella confirms the fact that the zoarium is not formed of two *Idmoneas* joined by their dorsal. The aperture is circular and placed entirely above the zooecial area. The figure given by D'Orbigny is entirely too regular.

The tetragonal aspect of the zoarium is more an optical effect resulting from the arrangement of the tubes, for it does not show very clearly in transverse sections.

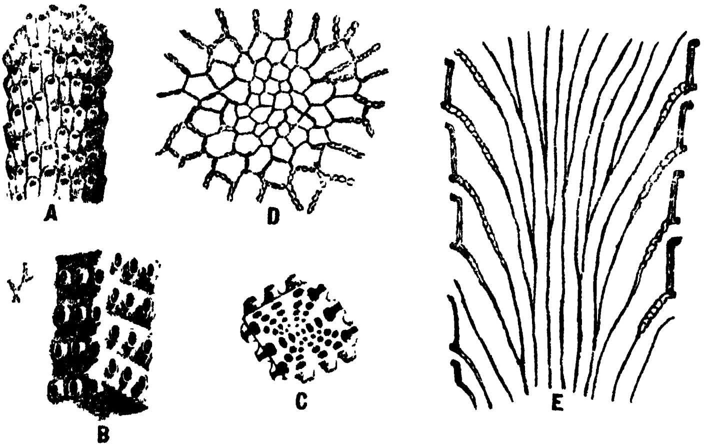


FIG. 4.—Bisidmonea tetragona Lamouroux.

A. Part of a branch, × 4, showing arrangement of the tubes. (After Gregory, 1896.)

B, C. D'Orbigny's diagrammatic views of a branch and a cross section, emphasizing the tetragonal shape.

D. Transverse section, × 16.

E. Longitudinal section, × 16. The walls are vesicular in the expanded parts of the tubes. The latter are closed by a facette perforated by the aperture.

Jurassic (Bathonian): Ranville (Calvados), France.

Occurrence.—Jurassic (Bathonian): Ranville (Calvados), France.

Plesiotypes.—Cat. No. 68916, U.S.N.M.

BISIDMONEA? GLOBULOECIA, new species.

Plate 3, figs. 7–10.

Description.—The zoarium is quadrangular and formed as if two specimens of *Idmonea* were joined by their dorsal; the fascicles are formed of three tubes and arranged alternately on each side of the zooecial area. The figure given by D'Orbigny is entirely too regular. thread; the peristome is thin, elliptical, salient. The ovicell is a large orbicular sack, quite *globular*, smooth, very salient, broad as a zoarial face; the oeciostome is anterior and little transverse.

Measurements.	Diameter of peristome	0.17 mm.
	Distance between fascicles	.32 mm.
	Width of branches	.60 mm.
	Diameter of ovicell	.35 mm.

The number of specimens has not permitted us to verify the sections. The aspect of the ovicell is similar to that in the Eleidae, so that the classification of this species is doubtful.

Occurrence.—Cretaceous (Cenomanian): Montlouet (Maine-et-Loire), France.

Holotype.—Canu collection.

Family PLAGIOECIIDAE Canu, 1918.

1918. *Plagioeciidae* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 16, p. 327.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull, 106, U. S. National Museum, p. 707.

The longitudinal axis of the ovicell is at right angles to the zooecial axis. The ovicell is formed before the calcification of the neighboring tubes, the formation of which it hinders. The oeciostome is small.

The genera exhibiting this type of ovicell are *Plagioecia* Canu, 1918, *Desmeplagioecia* Canu and Bassler, 1920, *Notoplagioecia*, new genus, *Terebellaria* Lamouroux, 1821, *Cea* D'Orbigny, 1852, *Laterocea* D'Orbigny, 1852, *Stathmepora*, new genus, and *Cavaria* Hagenow, 1851.

Genus PLAGIOECIA Canu, 1918.

1918. *Plagioecia* CANU, Les ovicelles des bryozoaires cyclostomes, Bulletin Société Geologique de France, ser. 4, vol. 4, vol. 16, p. 327.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 707.

The ovicell is a long transverse sack obliterating a certain number of zooecial tubes and developed in the vicinity of the zoarial margins. The oeciostome is small, equal to or less than the zooecial diameter. The tubes are isolated from each other. No adventitious tubes.

Genotype.—*Plagioecia* (*Tubulipora*) *patina* Lamarck, 1816.

This genus well exemplifies the variation in methods of growth shown in a group of species all agreeing in their ovicell and zooecial structure. The species we have selected for description illustrate the *Berenicea*, *Discosparsa*, *Mesenteripora Entalophora*, and *Reticulipora* growths, although all of these same methods may occur in other genera and families.

PLAGIOECIA VARIANS Ulrich, 1901.

Plate 8, fig. 12.

1901. *Discosparsa varians* ULRICH, Maryland Geological Survey, Eocene, Bryozoa, p. 205, pl. 59, fig. 3.

1907. *Discosparsa varians* ULRICH and BASSLER, Geological Survey of New Jersey, Paleontology, vol. 4, p. 315, pl. 21, figs. 1, 2.

Measurements.—Diameter of the peristome........... 0.14 mm.

Structure.—The tubes are large; their orifices are very close to each other. The ovicell is transverse, long and narrow. Its outlines are indistinct. The marginal tubes are supported on its convexity. The oeciostome is small, very narrow, subterminal. The basal lamella is very short and the zone of growth is quite visible.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, New Jersey.

Geologic distribution.—Lowest Eocene (Bryozoan bed at base of Aquia formation): Upper Marlboro, Maryland.

Plesiotypes.—Cat. No. 52593, U.S.N.M.

PLAGIOECIA DIVAGANS Canu and Bassler, 1920.

Plate 10, fig. 6.

1920. *Plagioecia divagans* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 712, pl. 121, figs. 1–7.

On plate 10, we figure the ovicell of this interesting species, which structure, although known, has hitherto not been illustrated.

Occurrence.—Jacksonian and Vicksburgian, various localities in Mississippi and other southern States.

Plesiotype.—Cat. No. 68917, U.S.N.M.

PLAGIOECIA AMERICANA Ulrich and Bassler, 1907.

Plate 3, figs. 13–15.

1907. *Berenicea americana* ULRICH and BASSLER, Bryozoa, Geological Survey of New Jersey, Paleontology, vol. 4, p. 315, pl. 20, fig. 7.

Measurements.—	Diameter of peristome	0.10 mm.
	Zooecial width	.12 mm.
	Distance between tubes	.50–0.80 mm.
	Separation of orifices	.36– .44 mm.

Structure.—The tubes are but slightly convex, almost flat. The peristome is elliptical or oval often acuminated distally. They are shorter (fig. 15) in the vicinity of the ancestrula (0.50 mm.) and longer on the zoarial margins (fig. 14), where they measure almost 0.80 mm. The separation is much more constant (about 0.40 mm.).

The ovicell is elliptical, transverse, little globular, little expanded; as shown in our figures it is almost orbicular. The oeciostome is of the same size as the peristome; it is turned toward the center of the zoarium.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, New Jersey.

Holotype and plesiotypes.—Cat. No. 52586, U.S.N.M.

PLAGIOECIA COMPRESSA Goldfuss, 1827.

Plate 5, figs. 1, 2.

1827. *Ceriopora compressa* GOLDFUSS, Petrefacta Germaniae, Bryozoa, vol. 1, p. 37, pl. 9, fig. 4.
1853. *Mesenteripora compressa* D'ORBIGNY, Paleontologie française, Terrain Crétacé, p. 811, pl. 756, figs. 10–13.
1899. *Diastopora compressa* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 132.

We believe this is the species that Pergens has identified incorrectly with *Mesenteripora meandrina* Wood, 1856. Gregory has already limited the species to Cretaceous specimens alone. In fact, the ovicell is not of the same nature as that of the specimens from the English Crag and of the recent specimens of the coast of California.

This species is a typical *Plagioecia.* The ovicell is very long and elliptical; it often results from the fusion of two or three secondary ovicells, and it is not rare to see two or three very small perforations representing the oeciostomes.

A character which renders the determination of this species easy is the fluting which ornaments the tubes. The zoarium is a *Mesenteripora;* that is to say, a bilamellar zoarium with undulated fronds. It is sometimes multilamellar.

Occurrence.—Cretaceous (Neocomian): St. Croix, Switzerland.

Cretaceous (Turonian): Fontaine d'Antoigne, near Chatellerault (Vienne), Les Janières, St. Calais and Duneau (Sarthe), Luynes (Loir-et-Cher), and Parnay (Indre-et-Loire), France.

Cretaceous (Coniacian): Tours (Indre-et-Loire), Villedieu (Loir-et-Cher), and Les Phelippeaux (Charente), France.

Cretaceous (Santonian): Houssaye and Vendome (Coulommiers). (Loir-et-Cher), and Bedocheau (Charente), France.

Cretaceous (Maastrichtian): Maastricht, Holland.

Cretaceous (Danian): Möen, Denmark.

PLAGIOECIA CLYPEIFORMIS D'Orbigny, 1853.

Plate 3, fig. 11.

1853. *Discosparsa clypeiformis* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 824, pl. 758, figs. 6–9.

Ovicelled specimens of this species are quite rare. The ovicell is long and thin, salient and parallel to the zoarial margins. The species is rather easy to determine in the French material and D'Orbigny's figure is exact. The zoarium has the *Discosparsa* form of growth.

Occurrence.—Cretaceous (Turonian): Fontaine d'Antoigné near Chatellerault (Vienne), France.

PLAGIOECIA OBLIQUA D'Orbigny, 1851.

Plate 5, figs. 9–12.

1851. *Reticulipora obliqua* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 906, pl. 610, figs. 1–5; pl. 768, figs. 1, 2.

1899. *Crisina (Reticrisina) obliqua* GREGORY, Catalogue of the Cretaceous Bryozoa, p. 178, pl. 8, figs. 8, 9, and fig. 13 (cites bibliography and geological distribution).

Structure.—*Reticulipora* is a very curious zoarial form, long considered as generic; it results from a folding of a primitively Berenicoid zoarium and of the turning toward the top of the folded fronds. The ovicells observed indicate that this zoarial form may be produced in very different families.

Here the ovicell is elliptical or fusiform, quite long, transverse, arranged parallel to the zoarial margins, and obliquely to the tubes. It is located among the tubes, the development of which it retards, but it may be placed on the margin itself of the zoarium. We give some illustrations which show its variations in size, form, and position.

This species is common in the European Cretaceous and specimens with ovicells are not rare. In the American Tertiary (Vicksburgian) we have a species with a *Reticulipora* zoarium belonging to *Exochœcia* a genus of the Mecynoeciidae.

Occurrence.—Cretaceous (Coniacian): Tours (Indre-et-Loire), France.

NOTOPLAGIOECIA, new genus.

Greek: *Notos*, back, dorsal.

The ovicell is an irregular convex capsule replacing many peristomes. The tubes are short, clubshaped with thick moniliform walls at their extremities. The gemmation is *dorsal.* There is no basal lamella.

Provisional genotype.—*Notoplagioecia farringdonensis*, new species.

Range.—Cretaceous (Aptian-Coniacean).

In the genus *Plagioecia* Canu, 1917, there are species provided with a basal lamella and others that are deprived of it. The first group has triparietal gemmation while the second has dorsal gemmation. It is convenient to regard the second group as a distinct genus. In this new genus, *Notoplagioecia*, it is necessary to classify the following species in addition to the new species here described, *Laterotubigera flexuosa* D'Orbigny, 1853, and *L. annulata* D'Orbigny, 1853.

Many other species of the genus *Laterotubigera* D'Orbigny, 1853, appear to belong to this new genus. Perhaps it will ultimately be found that D'Orbigny's genus *Laterotubigera*, possesses the same characters of ovicell and gemmation, but at present this genus can not be recognized.

NOTOPLAGIOECIA FARRINGDONENSIS, new species.

Plate 1, fig. 18.

Description.—The zoarium is free, cylindrical or compressed. The tubes are indistinct, very little convex, smooth. The peristomes are orbicular, thin, arranged in quincunx or in transverse rows. The zone of growth is an elevated cone. The ovicell is an irregular sack covering many adjacent tubes.

Measurements.-	Diameter of aperture	0.16 mm.
	Diameter of peristome	.20 mm.
	Distance of peristome	.48–0.56 mm.
	Separation of peristomes	.72 mm.
	Diameter of branches	3.00 mm.

Structure.—In longitudinal sections the tubes are short, club shaped, much expanded at their terminal parts, sometimes showing pseudofacettes. The gemmation is dorsal, although triparietal in appearance because of the little length of the tubes. The walls are moniliform, much widened at their extremity.

In transverse sections the tubes are rounded, much smaller at the center than at the circumference, with very thick vesicular walls, especially at the periphery.

Occurrence.—Lower Cretaceous (Aptian): Farringdon, England.

Cotypes.—Cat. No. 68718, U.S.N.M.

NOTOPLAGIOECIA MAGNIPORA, new species.

Plate 5, figs. 3, 4.

Description.—The zoarium is free, cylindrical, bifurcated (*Entalophora* form of growth). The tubes are indistinct, large, open in quincunx, not raised at their extremity; the peristome is very thin and scarcely salient. The ovicell is enormous, very convex, covering half of the zoarium; the oeciostome is much smaller than a zooecium, somewhat salient and placed at the distal extremity.

Measurements.—	Diameter of peristome	0.25–0.30 mm.
	Distance of orifices	.83– .85 mm.
	Separation of orifices	.83– .85 mm.
	Diameter of branches	2.10 mm.

Affinities.—In the size of the peristomes, this species can only be compared to *Entalophora grandipora* Vine, 1885, of the English Coniacian, but it differs in its nonvisible tubes and in its lesser distance between the orifices.

In species of *Plagioecia* we rarely find the oeciostome because it is very small and is confused with the secondary perforations of the surface. Here, however, it is quite visible, although remaining very small in comparison with the tubes.

Occurrence.—Cretaceous (Coniacian): Tours (Indre-et-Loire), France.

Cotypes.—Canu collection.

NOTOPLAGIOECIA FLEXUOSA D'Orbigny, 1853.

Plate 5, fig. 5.

1853. *Laterotubigera flexuosa* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 715, pl. 754, figs. 2–4.

Affinities.—In its small dimensions this species is quite close to *Mecynoecia micropora* D'Orbigny, 1853, but its peristome is always elliptical and transverse. This difference is quite important and moreover the ovicell is of an absolutely different type. In spite of appearances the two species do not belong to the same family.

The peristome measures 0.14 by 0.20 mm. and the diameter of the tubes is 0.20 mm. Almost all the peristomes are adjacent to each other.

It differs from *Notoplagioecia* (*Semilaterotubigera*) *annulata* D'Orbigny, 1853, in which the peristome is also transverse in its micrometric dimensions.

Geologic distribution.—Cretaceous (Turonian): Angouleme (Charente), France.

Cretaceous (Coniacian): Tours (Indre-et-Loire) and Villedieu (Loir-et-Cher), France.

Cretaceous (Santonian): Barbezieux (Charente), France.

NOTOPLAGIOECIA ANNULATA D'Orbigny, 1853.

1853. *Semilaterotubigera annulata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 750, pl. 762, figs. 13–15.

We have not yet discovered the ovicell of this rather common species, which, nevertheless, is easily distinguished by its micrometric dimensions from *Mecynoecia micropora* D'Orbigny, 1853, and from *Notoplagioecia flexuosa* D'Orbigny, 1853. This is the largest species of the three; the transversal diameter of the peristome is from 0.18–0.20 mm. and that of the tubes from 0.26–0.30 mm

The tubes are bent upward at their extremity and the peristome is slightly oblique. Illuminated from below, the latter appears transverse, but it appears orbicular when lighted from above. This peculiarity is the cause of the disorder which exists in D'Orbigny's specimen tubes and of his somewhat erroneous figure.

The zoaria are generally hollow and are terminated at their extremity by a solid part, as has been well figured by Pergens. They are often quite large and attain one centimeter in width.

One must not confound this species with *Laterotubigera macropora* D'Orbigny, 1853, in which the dimensions are much larger (peristome=0.30 mm. and transversal diameter=0.40 mm.). The bibliography of this species given by Gregory in 1899 is absolutely false.

Geological distribution.—Cretaceous (Coniacian): Tours (Indre-et-Loire), St. Paterne and Connerre (Sarthe), Villedieu (Loir-et-Cher), and Les Phelippeaux (Charente), France.

Cretaceous (Santonian): Vendome (Coulommiers) and Bedocheau (Charente), France.

Cretaceous (Maastrichtian): D'Archiac (Charente), France.

Genus CAVARIA Hagenow, 1851.

1851. *Cavaria* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 53.

Plagioeciidae in which the ovicell is globular, transverse, arranged perpendicularly to the zooecial axis and aborting many of the tubes. The tubes are cylindrical, with peristome, and with dorsal gemmation on the basal lamella. The zoarium is cylindrical, hollow, often with diaphragms irregularly placed in the interior.

Genotype.—*Cavaria pustulosa* Hagenow, 1851.

Range.—Maastrichtian, Danian.

Historical.—Hagenow applied the term *Cavaria* to zoaria, which were hollow and had diaphragms in the interior. This characteristic is very inconstant and may be often observed in *Entalophora* forms of growth and more frequently in the Ascosoeciidae. Quite often, especially on little complete zoaria, this character is only partially developed. This zoarial form probably corresponds to some kind of symbiosis on a marine alga.

The first species described by Hagenow is *Cavaria ramosa*, which was chosen in 1887 by Marsson as the type of his genus *Cavarinella*, referred by us to the Ascosoeciidae. Gregory was therefore in error in 1899 when he chose this species as the type of the genus *Cavaria*. Moreover, the section which he publishes does not conform to that of Marsson. The second species, *Cavaria pustulosa*, here chosen as the genotype, has afforded characters upon which we have established the above diagnosis. Gregory in 1899 classed the genus in the Ditstoporidae, which, however, is not a natural family.

CAVARIA PUSTULOSA Hagenow, 1851.

Plate 5, figs. 6–8.

1851. *Cavaria pustulosa* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 54, pl. 6, fig. 2.

1887. *Cavaria pustulosa* MARSSON, Die Bryozoen der weissen Schreibkreide der Insel Rügen, Palaeontologische Abhandlungen, vol. 4, p. 18, pl 1, fig. 5.

1899. *Cavaria pustulosa* **Gregory**, Catalogue of Bryozoa in Department of Geology of British Museum, The Cretaceous Bryozoa, vol. 1, p. 137 (cites bibliography and geologic distribution).

Structure.—Our specimens from Faxe correspond to Hagenow's figures and those from Herfolge to the illustrations given by Marsson. Nevertheless in these two aspects the ovicell is the same. The oeciopore appears to be represented by one or two very small pores, as is usual in the family.

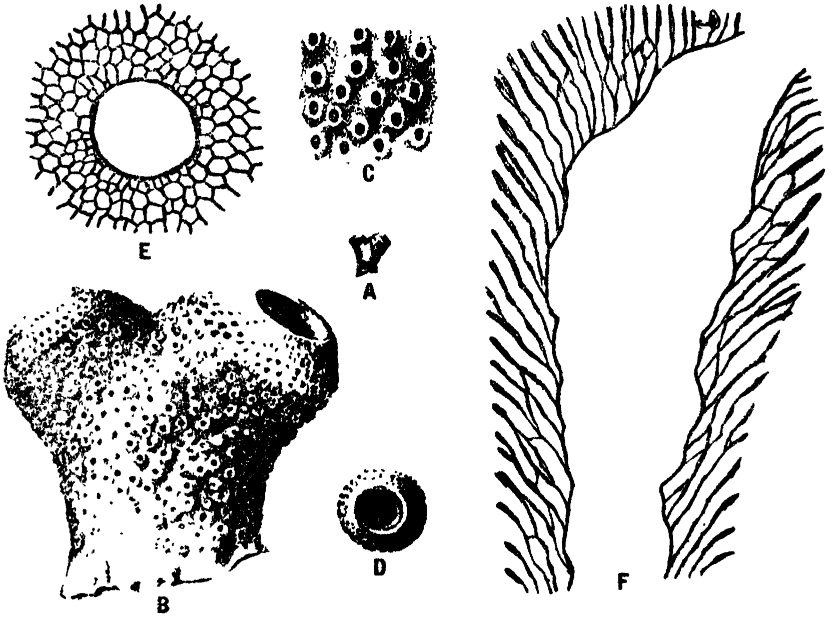


Fig. 5.—Cavaria pustulosa Hagenow, 1851.

A–D. Hagenow's figures showing a branch natural size (A), a portion enlarged (B), the surface further enlarged (C), and the end of the hollow branch (D).

E. Transverse section, × 12, showing the central zoarial cavity and the thick basal lamella.

F. The same features as shown in a longitudinal section, × 12.

Cretaceous; Maastricht, Holland (A–D) (Maastrichtian); Herfolge, Denmark (E, F) (Danian).

The longitudinal section indicates short, cylindrical tubes with dorsal gemmation. The transverse section indicates a thick basal lamella. The tubes are so short that the gemmation could be considered as triparietal if the basal lamella was calcified before the tubes.

Occurrence.—Cretaceous (Danian): Faxe and Herfolge (Seeland), Denmark. Also Maastrichtian at Maastricht, Holland.

Plesiotypes.—Cat. Nos. 68919, 68920, U.S.N.M.

Genus TERELBELLARIA Lamouroux, 1821.

1821. *Terebellaria* Lamouroux, Exposition méthodique des generes de l'order des Polypiers, p. 84.

The ovicell is long, convex, salient, transverse. The oeciostome is round, salient, distal, turned toward the base.

According to Gregory, the zoarial growth is by the addition of Berenicoid colonies on the ends of the branches; each colony sends an expansion downward around the stem. The zooecia are reflexed. The apertures occur in zones separated by interzones of dactylethrae.

Genotype.—*Terebellaria ramosissima* Lamouroux, 1821. Range, Jurassic, Cretaceous.

TEREBELLARIA RAMOSISSIMA Lamouroux, 1821.

Plate 10, figs. 7–19.

1899. *Terebellaria ramosissima* Gregory. Catalogue Fossil Bryozoa in British Museum, Jurassic, p. 188, pl. 10, fig. 5 (cites bibliography).

This well known and frequently quoted bryozoan, described in detail by Gregory, has still never been located in a natural classification. Our discovery of the *Plagioecia*-like ovicell now enables its position to be determined.

Occurrence.—Jurassic of France and England.

Plesiotypes.—Cat. No. 32286, U.S.N.M.

THE CEIDAE OF D'ORBIGNY.

1852. Ceidae d'Orbigny, Paléontologie française, Terrain Crétacé, vol 5, p. 1000.—1889. Pergens, Revision des Bryozoaires du Crétacé figuré par d'Orbigny, Bulletin Société belge de géologie, vol. 3, p. 310, fig 23.—1899. Canu, Les ovicelles des Céidees, Bulletin de la Société géologique du France, ser. 3, vol. 27, p. 326.—1907. Filliozat, Bryozoaires crétacés de Vendôme, Bulletin de la Société géologique de France, ser. 4, vol. 7, p. 397.

Structure.—D'Orbigny characterized this family as follows: "Cellules centrifugineé [Cyclostomes], foraminées [without peristome] dont l'ouverture est evasée exterieurement."

We have prepared quite a number of sections in an endeavor to determine the structure of these fossils and have noted, first, that the tubes are conical, without peristome, oriented, with triparietal gemmation; second, the extremity of the tubes has dilated walls; third, a small oral tongue gives to the orifice its funnel-shaped form.

This form of the tube, club-shaped and without peristome, is not peculiar to the Cretaceous formations, as we possess Tertiary forms, and even recent ones not yet described, which have this structure. According to Pergens, *Cinctipora elegans* Hutton is a living representative; but this species has not yet been studied in detail.

The mode of gemmation is analogous to that of all the species with oriented zooecia. We have observed some interesting peculiarities.

The zooecia are shorter and in the lamellar forms they are detached from the basal lamella at a much greater angle. This phenomenon is observed frequently in the Paleozoic genera of the Order Cryptostomata and represents triparietal gemmation.

In the cylindrical forms the zoarial axis is a long tube serving as a much reduced basal lamella for all the other zooecia. This tube branches many times in its length, and its ramifications themselves serve as basal lamella to the adjacent zooecia.

The dilation of the zooecial walls at their extremity has been mentioned by Pergens, 1889. In the median axis of this dilation we observe a sort of linear or moniliform canal, a lumen rather apparent communicating with the exterior. We have not had the chance to observe "les petits canaux, ordinairement simples, quelquefois bi- ou trifurqués, traversant la partie epaissie, en rayonnant autour de la cavité centrale" (pl. 6, fig. 9), noted by Pergens; probably our sections are not thin enough. About the central lumen we have observed a lamellar structure slightly resembling that which Cumings and Galloway have noted at the base of the acanthopores in the Paleozoic genus *Dekayia* and analogous to that which Ulrich, 1890, has figured in *Rhombopora*.

The funnel-shaped form of the orifice is caused by the presence of a small calcareous tongue of variable size, which is often even absent. It is sometimes transformed into a true perforated diaphragm (=closure of Levinsen); the zooecia have then the aspect of the zooecia in the Eleidae and constitute the ectocystal zooecia of Filliozat; their orifice is orbicular and not semilunar.

The physiologic rôle of this tongue-diaphragm is absolutely unknown, like that of the ornamented closure in the Eleidae. Perhaps the tentacles were less numerous or much finer than in the other species of Cyclostomata.

The tubes of the Ceidae have therefore a very special form and quite characteristic between the conical, ordinary tubes without peristome and the tubes of the Eleidae.

The ovicells have been discovered by Pergens in 1893; Canu in 1899 and Filliozat in 1907 have described some forms. Their nature and their mode of formation classifies them among the Plagioeciidae. They are not parallel to the zoarial margins, except in the case of the union of many adjacent ovicells; they are more or less orbicular, globular and smooth; their contours are irregular and poorly defined. The oeciostome is a very minute pore placed in the proximal region; one ovicell may bear many oeciostomes. The identity with the ovicell of the genus *Plagioecia* is therefore not perfect, but the resemblances are sufficient to justify the classification of the two in the same family.

The genera *Cea*, *Semicea*, and *Filicea* of D'Orbigny are distinguished only by zoarial differences and ought to be united into a single genus. The genus *Reptocea* requires further examination. The genus *Laterocea* is peculiar for its tubes are cylindrical and not club-shaped. The study which we have made of this genus, in which the ovicell is identical with that of *Cea*, shows at once that the form of the tubes is only a generic character. Following are the new generic diagnoses.

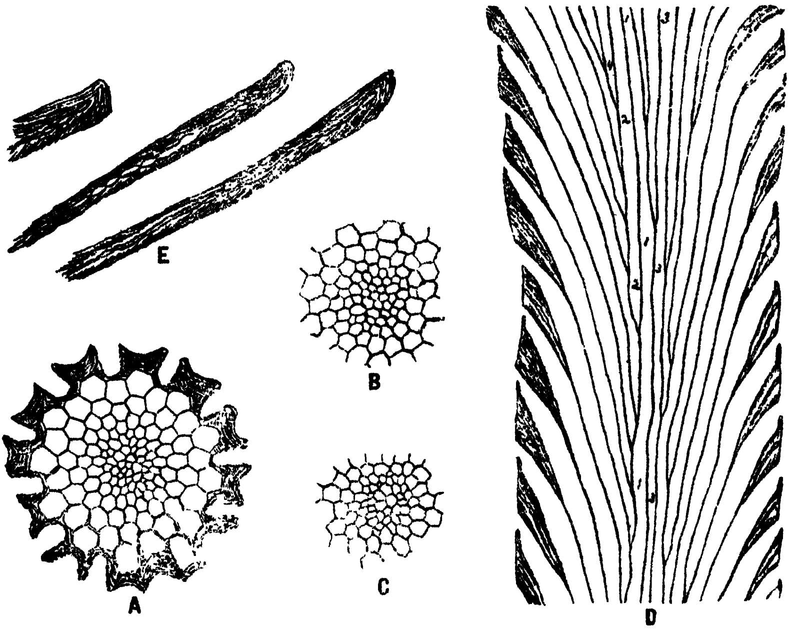


FIG. 6.—Cea (Filicea) regularis D'Orbigny, 1852.

A. Transverse section, × 16, showing the thick zoarial walls. The section cuts the branch a little above the bifurcation of the central tube which is thus represented by a small pore.

B. Central part of a transverse section, × 16, showing the central tube replacing the basal lamella.

C. Another transverse section, × 16, with the central tube surrounded by a circle of tubes of the same diameter, all of which replace the basal lamella.

D. Longitudinal section, × 16, there are two central tubes (1, 3). Tube 1 divides to form tube 2 which in turn gives rise to tube 4. The cross section of figure B is along the line through the middle of the section while that of figure C is through the top part. The walls are much thickened at their extremity and bear an oval projection which may be transformed into a perforated diaphragm.

E. Structure of the zooecial walls at the extremity × 50, showing a moniliform, central, clear space surrounded by laminated tissue.

Cretaceous (Coniacian); Villedieu (Loir-et-Cher), France.

Genus CEA D'Orbigny, 1852.

1852. *Cea* D'ORBIGNY, Paléontologie française, Terrain Cétacé, vol. 5, p. 1004.

The oeciopore is a very minute pore. Gemmation is triparietal. The tubes are club-shaped, oriented and without peristome: the extremity of the walls is dilated: a small oral tongue very irregularly developed gives to the orifice a quite variable funnel-shaped form.

Genotype.—*Cea rustica* D'Orbigny, 1852. Cretaceous.

The species belonging to this genus are:

Cea rustica D'Orbigny, 1852 (pl. 6, figs. 1, 2.)
Cea compressa D'Orbigny, 1852 (=*C. subcompressa* Pergens, 1885, and *C. digitata* D'Orbigny, 1852 (pl. 6, figs. 3-9).
Cea lamellosa D'Orbigny, 1852 (pl. 6, fig. 10).
Cea tuberculata Canu, 1897.
Cea (Filicea) regularis D'Orbigny, 1852 (pl. 7, figs. 7-10).
Cea velata Hagenow, 1839.
Cea subcompressa D'Orbigny, 1852 (pl. 6, figs. 12-14.)
Cea rhomboidalis D'Orbigny, 1852.
Cea obliqua D'Orbigny, 1852.
Cea (Semicea) tubulosa D'Orbigny, 1852 (pl. 6, fig. 11).
Cea (Semicea) lamellosa D'Orbigny, 1852.

CEA SUBCOMPRESSA D'Orbigny, 1853.

Plate 6, figs. 12-14.

1853. *Filicea subcompressa* D'Orbigny, Paléontologie francaise, Terrain Crétacé. vol 5, p. 1001, pl. 786, figs. 5, 7.

We have been fortunate enough to discover two ovicelled specimens of this species, which is not rare in France. The ovicell in one is convex, but in the other is flat and embedded in the zoarium. However, it is quite rare that the ovicells of the same species and even of the same zoarium resemble each other exactly in size and form.

The oeciopore is very small. One of our specimens bears two oeciopores. The presence of these small pores is so constant that they can scarcely be interpreted otherwise.

The synonomy of this species is cited by Pergens in 1889 and by Gregory in 1899. We have not enough data for comparison, and we prefer simply to preserve D'Orbigny's name.

Occurrence.—Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

Plesiotypes.—Cat. No. 68921, U.S.N.M.

Genus LATEROCEA D'Orbigny, 1852.

1852. *Laterocea* D'ORBIGNY, Paleontologie française, Terrain Crétaée, vol. 5. p. 1003.

The oeciopore is a very small pore. The tubes are cylindrical, branched, dilated at their distal extremity; the walls are thick at their extremity.

Genotype.—Laterocea simplex D'Orbigny, 1852. Cretaceous (Senonian).

LATEROCEA SIMPLEX D'Orbigny, 1852.

Plate 7, fig. 6.

1852. *Laterocea simplex* D'ORBIGNY, Paleontologie française, Terrain Crétacé, vol. 5, p. 1004, pl. 786, figs. 14–16.

Structure.—Exteriorly the zooecia of *Laterocea simplex* are arranged in transverse rows, the feature upon which D'Orbigny founded the genus, but this character is rather variable and can not be generic.

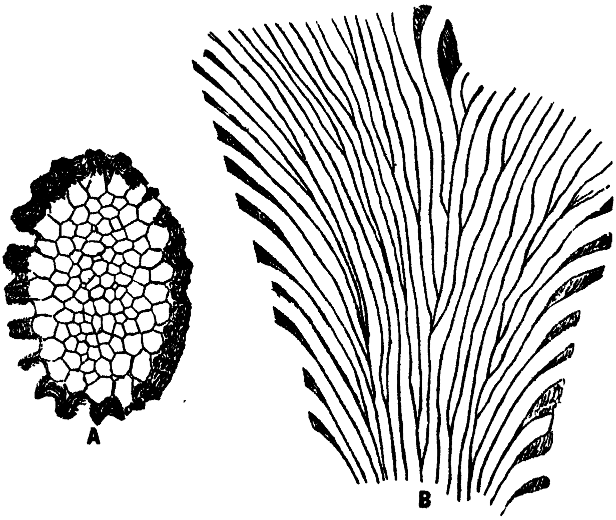


FIG. 7.—Laterocea simplex D'Orbigny, 1852.

A. Transverse section, × 16.

B. Longitudinal section, × 16. The tubes are cylindrical and have their terminal walls thickened.

Cretaceous (Coniacian): Villedieu (Loir et Cher), France.

In transverse section we note that the tubes are almost of the same diameter, as in all the species with cylindrical tubes. The zoarial margins are very thick, which implies a considerable thickness of the extremity of the zooecial walls.

In longitudinal section the tubes are cylindrical in the greater part of their length; they are not oriented, but are dichotomously branched. This mode of gemmation gives to the zoaria a great irregularity. The extremity of the zooecial walls is strongly dilated like a club in the genus *Cea.* We are not certain of the presence of an oral tongue.

Occurrence.—Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

Plesiotypes.—Cat. No. 60404, U.S.N.M.

STATHMEPORA, new genus.

This genus is characterized by the arrangement of the peristomes into linear fascicles and by an ovicell formed somewhat before the consolidation of the fascicles. The peristomies of the fascicles cease therefore to be adjacent in the ovicelled portion of the zoarium; they are isolated since they are consolidated at the same time as the ovicell. The oeciopore is a very minute perforation placed near the first tube of a linear fascicle.

Genotype.—*Stathmepora flabellata*[5] new species from the Pleistocene of California.

In *Plagioecia* the tubes are never grouped into linear fascicles. Generally the ovicell has been consolidated before the peristomes which brings about the abortion of a certain number of tubes. Still sometimes the peristomes have been consolidated before the ovicell and thus brings about their abortion. This phenomenon is readily observed in *Plagioecia* (*Berenicea*) *diluviana* Lamouroux, 1821, of which Canu, 1900, has given several ovicell variations.

Bisidmonea johnstrupi Pergens, 1886, and *Bisidmonea gabbiana* Ulrich and Bassler, 1907, belong to this new genus whose geologic range dates from the Danian.

The zoarium of *Stathmepora flabellata*, new species, from the Pleistocene at Santa Monica, California, has the zoarial form of *Mesenteripora.*

The ovicell of *Bisidmonea antiqua* D'Orbigny, 1852, the genotype of *Bisidmonea* proves to be of the type characterizing the Mecynoeciidae, in which family we have placed this genus.

STATHMEPORA GABBIANA Ulrich and Bassler, 1907.

Plate 7, figs. 4, 5.

1907. *Bisidmonea gabbiana* ULRICH and BASSLER, Bryozoa, Cretaceous Paleontology of New Jersey. Geological Survey of New Jersey, Paleontology, vol. 4, p. 320, pl. 22, figs. 1, 2.

The authors of this species have figured the ovicell, but they did not describe it. We are reproducing the types with a greater magnification.

---

[5] Described and illustrated in our monograph on the Later Tertiary and Quaternary Bryozoa of North America, now in press.

The oeciopore is a small proximal pore placed in the vicinity of a peristome.

The ovicell is a globular sac, developed transversally, and probably arising from a tube coming from the vicinity of the ancestrula. In its formation it disarranges the peristomie of the tubes which then cease to be adjacent to each other, and some of which are even aborted. The ovicell is therefore formed a little before the complete development of the peristomies. Their formation is almost simultaneous.

In longitudinal section the tubes are cylindrical, with tripariotal gemmation, and developed on a basal lamella. The meridian section, made near this lamella, shows the usual lozenge shaped areas characteristic of dorsal gemmation.

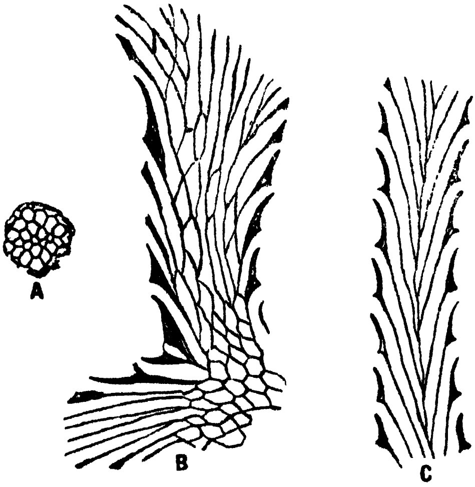


FIG. 8.—Stathmepora gabbiana, Ulrich and Bassler, 1907.

A. Transverse section, × 16. The tubes are cylindrical.
B. Meridian section, × 16.
C. Longitudinal section, × 16, illustrating the triparietal gemmation.
Cretaceous (Vincentown): Vincentown, N. J.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, New Jersey.

Cotypes.—Cat. No. 52588, U.S.N.M.

STATHMEPORA JOHNSTRUPI Pergens, 1886.

Plate 7, figs. 1-3.

1886. *Bisidmonea johnstrupi* PERGENS, La faune des Bryozoaires Garumniens de Faxe, Annales de la Société Royal Malacologique de Belgique, Bruxelles, vol 21, pp. 37, 219, pl. 12, figs. 1-6.

1892. *Bisidmonea johnstrupi* HENNIG, Studier öfver Bryozoerna i Sveriges Kritsystem, I Cheilostomata, Lunds Universitets Arsskrift, vol. 28, No. 11, p. 10.

We have been able to secure ovicells of this remarkable species and have chosen the two which differ the most for illustration. They are similar to the ovicell of *Stathmepora* (*Bisidmonea*) *gabbiana*. Ulrich and Bassler, 1907. Most of the tubes in lines are aborted, but there persists always at least one which opens above the convexity of the ovicell. One of the tubes is perhaps the oeciostome, but we have not cared to dissect our specimens. As in the American species, there is a simultaneity in the calcification of the ovicell and all the peristomies of the tubes.

Geological distribution.—Cretaceous: Danian of Denmark; Senonian of Switzerland.

Family DIAPEROECIIDAE Canu, 1918.

1918. *Diaperoeciidae* CANU, Les ovicelles des Bryozoaires Cyclostomes, Bulletin Société Géologique de France, ser. 4, vol. 16, p. 329.—1920. CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 738.

The ovicell is formed after the calcification of the distal tubes. It is an irregular, subglobular elevation placed among many tubes, which are not disarranged from their respective position but project on the ovicell itself. The oeciostome is submedian transverse, salient, often isolated, generally proximally directed.

The genera at present referred to this family are *Diaperoecia* Canu, 1918, *Diplosolen* Canu, 1918, *Lekythionia* Canu and Bassler, 1920, *Crisulipora* Robertson, 1910, *Desmediaperoecia* Canu and Bassler, 1920, and *Stigmatoechos* Marsson, 1887.

Genus DIAPEROECIA Canu, 1918.

1918. *Diaperoecia* CANU, Les ovicelles des Bryozoaires Cyclostomes, Bulletin Société Géologique de France, ser. 4, vol. 16, p. 329.—1920, CANU and BASSLER, North American Early Tertiary Bryozoa, Bull 106, U. S. National Museum, p. 740.

DIAPEROECIA POLYSTOMA Roemer, 1839.

Plate 7, fig. 11.

1839. *Cellepora polystoma* ROEMER, Die Versteinerungen des norddeutschen Oolithen-Gebirges Hannover, (1836) Nachtrag, p. 14, pl. 16, fig. 6.

1899. *Berenicea polystoma* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1. p. 10, pl. 5, fig. 5; pl. 6, fig. (Bibliography).

This little species is not rare. One recognizes it quite often in the Neocomian fossils in France, Germany, and Switzerland. More recently Gregory claimed to have rediscovered it in the Coniacian at Chatham, England, but he did not figure the ovicell.

Our ovicelled specimen indicates that this species is a *Diaperoecia;* unfortunately the oeciostome is not visible.

Occurrence.—Cretaceous (Neocomian); Gross Wahlberg, Germany, etc.

DIAPEROECIA PAPILLOSA Reuss, 1846.

Plate 7, fig. 12.

1846. *Diastopora papillosa* Reuss, Die Versteinerungen der böhmischen Kreideformation, pt. 2, p. 65, pl. 15, figs. 44, 45, p. 65 (*pusilla*); pl. 14, fig. 15.

1851. *Berenicea grandis* d'Orbigny Paléontologie française, Terrain Crétacé, vol. 5, p. 866, pl. 639, fig. 4, 5.

1851. *Berenicea echinata* d'Orbigny, Paléontologie française, Terrain Crétacé, vol. 5, p. 868, pl. 641, figs. 1, 2.

1889. *Diastopora papillosa*, Pergens, Révision des Bryozoaires du Crétacé figurés par D'Orbigny, Mémoires de la Société Belge de Géologie, de Paléontologie et d'Hydrologie, vol. 3, p. 334, pl. 12, fig. 1.

1899. *Berenicea papillosa* Gregory, Catalogue of the British Museum, Cretaceous Bryozoa, p. 81, pl. 5, figs. 6, 7, 8, 9 (Bibliography and Geological distribution).

1911. *Diastopora* (*Berenicea*) *papillosa* Canu, Iconographie des Bryozoaires fossiles de l'Argentine, Anales del Musee National de Buenos-ayres, vol. 21, p. 269, pl. 10, figs. 1 to 11 (not 4).

Gregory has figured the ovicell of this species. We have not been fortunate enough to discover the oeciostome. This ovicell is fusiform much elongated and always near the zoarial margins.

Geological distribution.—To the localities cited by Gregory it is necessary to add the following French localities from the Canu collection. Turonian at Duneau and Connerré (Sarthe) and Fontaine d'Antoigne near Chatellerault (Vienne); Coniacian at Les Phelippeax (Charente), Tours (Indre-et-Loire), and Fécamp (Seine Inferieure); Santonian at Piaud (Charente) and Romorantin (Loir-et-Cher); Campanian at Montomoreau (Charente); Maastrichtian at Deviat (Dordogne); Rocanian of Argentina.

DIAPEROECIA TURONICA, new species.

Plate 8, figs. 1–6.

Description.—The zoarium is a bushy *Mesenteripora* composed of undulated and distorted lamellae on which the peristomes are arranged in quincunx or in oblique lines, as in *Reticulipora.* The tubes are visible, almost flat, straight, bordered laterally by two very thin threads hardly salient: the apertura is elliptical, the peristome is thin and little salient. The zone of growth is wide and visible. The ovicell is large, globular, quite convex, elliptical, perforated by as many as 15 peristomes.

Measurements.—	Diameter of peristomes	0.12 mm.
	Distance between peristomes	0.50–0.64 mm.
	Separation of peristomes	.36– .44 mm.

Affinities.—This species differs from *Plagioecia compressa* D'Orbigny, 1852, not only in the nature of the ovicell, but also in the absence of a median furrow on the tubes; the zoarial aspect is identical and confusion between the two species is always possible without attentive observation.

Very often the distance and separation of the peristomes are very close measurements. Here on the contrary they are quite different, the visible length of the tubes being very large. It is the same in *Diaperoecia laxipora* D'Orbigny, 1852. *D. turonica* differs however from this species in its larger peristome (0.12 instead of 0.10 mm.) and in its less zooecial length never attaining 0.70 mm.

There are some specimens affecting the zooecial arrangement of *Reticulipora:* this is the result of the distorting of the lamellae, the growth being always exterior.

Occurrence.—Cretaceous (Turonian); Ruillé Poncé (Loir-et-Cher), France.

Cotypes.—Canu collection and Cat. No. 68922, U.S.N.M.

DIAPEROECIA LAXIPORA D'Orbigny, 1853.

1853. *Mesenteripora laxipora* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 812, pl. 756, figs. 14–17.

1890. *Mesenteripora laxipora* PERGENS, Révision des Bryozoaires du Crétacé figurés par D'Orbigny, Bulletin de la Société belge de Géologie, vol. 3, p. 369.

Measurements.—	Diameter of peristomes	0.10 mm.
	Distance between peristomes	0.70–0.80 mm.
	Separation of peristomes	.40 mm.

Affinities.—We have discovered the ovicell of this species and find it is identical with that of *Diaperoecia turonica*, but with somewhat smaller dimensions; we do not believe it is of any use to figure it.

This species is perfectly characterized by its great zooecial length, twice the separation of the peristomes. The zooecia are little distinct; however, it is not rare that they are bordered laterally by a thin salient thread which causes them to resemble those of *Diaperoecia turonica*. Confusion between the two species is not possible because of the great micrometric differences.

Occurrence.—Cretaceous (Santonian): Romorantin (Loir-et-Cher), France.

Geological distribution.—Coniacian of France (D'Orbigny). The Maestrichtian locality of Royan is cited in the Paleontologie française, but Canu has not found this species there.

DIAPEROECIA SAILLANS, new species.

Plate 8, figs. 12.

Description.—The zoarium is flabelliform or orbicular; and incrusts bryozoa (*Coscinopleura*). The tubes are large, little visible in their lower part; they are upward bent at their extremity, developing a long *salient* peristomie; the peristome is round, thin. The ovicell is very large, elliptical, transverse, very globular, traversed by the tubes.

Measurements.—	Diameter of peristome	0.14 mm.
	Zooecial width	.20 mm.
	Distance between orifices	.50 mm.
	Separation of orifices	.50 mm.
	Length of peristomie	.20 mm.

Affinities.—This beautiful species is quite well characterized by the length of its peristomie and its enormous ovicell. Unfortunately our specimen had no oeciostome. It differs from *Diplosolen lineatum* in the absence of the zooeciules. It differs from *Plagioecia americana* in the thickness of its convex tubes (0.14 and not 0.10 mm.) and in the different ovicell.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, New Jersey.

Holotype.—Cat. No. 68923, U.S.N.M.

DIAPEROECIA PUNCTATA, new species.

Plate 8, figs. 8–10.

Description.—The zoarium is cylindrical, entalophoroid. The tubes are little distinct, somewhat convex, swollen, contracted at their extremity, ornamented with two large *punctations* irregularly placed in the vicinity of the apertura. The peristome is little salient, rather thick; the apertures are arranged in regular quincunx. The ovicell is large, elliptical, very convex, traversed by the tubes and very often by their adventitious punctations.

Measurements.—	Diameter of peristome	0.14 mm.
	Diameter of tubes	.15 mm.
	Distances of orifices	.74 mm.
	Separation of tubes	.44 mm.
	Length of ovicell	1.65 mm.
	Width of ovicell	1.00 mm.
	Diameter of branches	1.00 mm.

Occurrence.—Cretaceous (Danian): Herfolge (Seeland), Denmark.

Holotype.—Cat No. 68924, U.S.N.M.

DIAPEROECIA TRANSVERSATA, new species.

Plate 8, fig. 7.

Description.—The zoarium is free; the branches are compressed and narrowed at their extremity. The tubes are indistinct; the peristomes are salient, thin, irregularly placed, adjacent or scattered. The ovicell is large, convex, elliptical, arranged *transversally*.

Measurements.—	Separation of tubes	0.50 mm.
	Diameter of branches	2.00 mm.
	Width of ovicell	1.90 mm.
	Length of ovicell	.75 mm.

Affinities.—In the genus *Diaperoecia* the large axis of the ovicell is generally arranged in the direction of the zoarial axis. Here the width is greater than the length and we have believed it useful to note this exception.

Occurrence.—Cretaceous (Danian): Herfolge (Seeland), Denmark.

Holotype.—Cat. No. 68925, U.S.N.M.

DIAPEROECIA COMPRESSA, new species.

Plate 9, figs. 1–5.

Description.—The branches of the zoarium are of bifoliate lamellae much *compressed.* The zooecia are distinct, flat, separated by a quite salient thread; the peristomes are thin, somewhat salient, arranged in irregular quincunx and always orbicular. The ovicell is globular, quite convex, elongated, traversed by tubes which are almost always closed by lamellae.

Measurements.-	Diameter of peristome	0.12 mm.
	Zooecial width	.16 mm.
	Zooecial distance	.55 to 0.64 mm.
	Separation of tubes	.44 to .48 mm.
	Width of branches	1.25 mm.
	Length of ovicell	1.20 to 1.60 mm.
	Width of ovicell	.60 to .70 mm.

Affinities.—In its exterior aspect and the salient separating threads of the tubes this species much resembles *Mesenteripora vaudensis* D'Orbigny 1852 of the Swiss Neocomian. Unfortunately we are ignorant of the ovicell of this species, and the type itself is missing from the Paris Museum. Comparison is therefore very difficult, but according to D'Orbigny's figures the branches appear much wider than those of our specimens.

Occurrence.—Cretaceous (Danian): Herfolge (Seeland), Denmark.

Cotypes.—Cat. No. 68926, U.S.N.M.

DIAPEROECIA DISTANS Hagenow, 1851.

Plate 9, fig. 19.

1851. *Escharites distans* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 56, pl. 1, figs. 16 *a–e*, *g*, *k*, *m* (not *f*, *h*, *i*, *l*, and fig. 17).

Our ovicelled specimen has much resemblance to that figured by Hagenow in 1851, but this author appears to have confused two species, not only of different genera, but also of very different families. We accept the interpretation of Pergens, 1887.

The arrangement of the tubes is as in *Peripora* and this is the first time that we have discovered an ovicelled specimen.

Gregory, in 1899, gives a long synonymy of this species. This appears premature to us and we can maintain it only when we have discovered in France ovicelled specimens of the different species of *Peripora* described by D'Orbigny.

Occurrence.—Cretaceous (Danian): Herfolge (Seeland), Denmark. Also in the Maastrichtian at Maastricht, Holland.

Plesiotype.—Cat. No. 68927, U.S.N.M.

DIAPEROECIA? AMERICANA Gabb and Horn, 1862.

Plate 9, figs. 6–10.

1862. *Fascipora americana* GABB and HORN, Journal Academy of Natural Sciences, Philadelphia, ser. 2, vol. 5, p. 165, pl. 21, fig. 54.

Description.—The zoarium is free, cylindrical, in the *Entalophora* form with the branches clavate, short, and bifurcated. The tubes are little distinct, very little convex, sometimes bordered; the peristome is thin, little salient, orbicular. The ovicell is large, elliptical, transverse, globular, salient, perforated by the widely separated tubes. The zone of growth is terminal and very thick.

Measurements.-	Diameter of peristome	0.14–0.16 mm.
	Distance between peristomes	0.50 mm.
	Separation of peristomes	0.50 mm
	Smallest diameter of branches	1.4 mm.
	Greatest diameter of branches	2.00 mm.

Affinities.—This species is quite well characterized by the clavate form of its branches; the upper part is wider and often is occupied by the ovicell. The tubes are sometimes flat and bordered with a very salient thread; generally they are little distinct. We have figured a branch in which the lower tubes are not pointed in the same direction as the upper tubes. We are unable to explain this curious growth.

At the base of the branches the length of the tubes varies from 0.90 to 1.00 mm. The ovicell is often almost analogous with *Plagioecia.* In reality this seems to be an intermediate type between *Plagioecia* and *Diaperoecia.* The discovery of the oeciostome will permit an exact generic classification.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, New Jersey.

Plesiotypes.—Cat. No. 68928, U.S.N.M.

Genus DIPLOSOLEN Canu, 1918.

This genus is like *Diaperoecia* save that adventitious tubules (zooeciules) are developed.

Genotype.—*Diplosolen* (*Berenicea*) *obelium* Johnston, 1847.

Range.—Cretaceous—Recent.

DIPLOSOLEN LINEATUM Gabb and Horn, 1862.

Plate 9, fig. 20.

1862. *Diastopora lineata* Gabb and Horn, Monograph of the fossil Polyzoa of the Secondary and Tertiary formations of North America, Journal Academy of Natural Sciences of Philadelphia, ser. 2, vol. 5, p. 172 pl. 21, fig. 62.

1868. *Diastopora lineata* Ulrich and Bassler, Bryozoa, Cretaceous Paleontology of New Jersey, Geological Survey of New Jersey, Paleontology, vol. 4, p. 316, pl. 21, figs. 3, 4.

Measurements.—	Diameter of peristome	0.12 mm.
	Distance between orifices	.50 mm.
	Separation of orifices	.54 mm.

The zoarium is hollow and subcylindrical; it therefore probably incrusted delicate algae at their bifurcation. The zooeciules are small, very constant; their diameter is a fourth of that of the ordinary tubes. They escaped the observation of Gabb and Horn, who do not mention them in their description.

The ovicell is quite large, very salient, globular, elliptical, with well defined outlines. Unfortunately our specimen has no oeciostome. A certain number of tubes are closed by a diaphragm; the orifices are elliptical; the zone of growth is short; it is therefore very probable that the tubes bear a very long, salient, and quite fragile peristomie.

Occurrence.—Cretaceous (Vincentown marl): Vincentown, Timber Creek and Mullica Hill, New Jersey.

Plesiotypes.—Cat. No. 68929, U.S.N.M.

DIPLOSOLEN ENTALOPHOROIDEA, new species.

Plate 9, figs. 21, 22.

Description.—The zoarium is free, cylindrical, entalophoroid, bifurcated. The tubes are distinct, separated by a little salient thread and scattered. The surface is almost smooth. The peristomes are little salient, thin, orbicular, arranged in regular quincunx. The zooeciules are small, distinct, and their aperture is generally placed in the vicinity of the zooecial orifice. The ovicell is very large, globular, elongated elliptical, traversed by the tubes and by the zooeciules, wider than the branches.

Measurements.—	Diameter of peristome	0.08 mm.
	Zooecial width	.10 mm.
	Distance of tubes	.32 mm.
	Separation of tubes	.48 mm.
	Diameter of branches	.75 mm.
	Width of ovicell	1.25 mm.
	Length of ovicell	2.00 mm.

Affinities.—The species of this genus are generally incrusting but this is the second species known having free branches.

Occurrence.—Cretaceous (Danian): Faxe, Denmark.

Holotype.—Cat. No. 68730, U.S.N.M.

Genus STIGMATOECHOS Marsson, 1887.

1887. *Stigmatoechos* MARSSON, Die Bryozoen der weissen Schreibkreide der Insel Rügen, Palaeontologische Abhandlungen, vol. 4, p. 32.

STIGMATOECHOS PUNCTATUS Marsson, 1887.

Plate 9, figs. 11–18.

1887. *Stigmatoechos punctatus* MARSSON, Die Bryozoen der weissen Schreibkreide der Insel Rügen, Palaeontologische Abhandlungen, vol. 4, p. 32, pl. 2, fig. 3.

The ovicell is an enormous hemispherical sack traversed by the tubes, arranged laterally on the anterior (cellular) face; the orifice of the tubes of the ovicell is often closed by a calcareous lamella. This structure is eminently that of the Diaperoeciidae.

On the anterior face the tubes are in quincunx but on the sides of the zoarium they are grouped in transverse rows.

The posterior, noncellular face is smooth and thickened. It does not present the characteristic sulci of the Horneridae, as Marsson believed.

Occurrence.—Cretaceous (Danian): Faxe, Denmark; Rugen, Germany.

Plesiotypes.—Cat. No. 68931, U.S.N.M.

Family TUBULIPORIDAE Johnston, 1838.

This family and its genera have been discussed at some length in our monograph on the Early Tertiary Bryozoa. Our purpose in the present connection is to give descriptions of several species showing variations in growth forms of several genera and to illustrate the structure of the genus *Tennysonia* Busk, 1867, which proves to be a member of the family.

The genera of this family with range are as follows:

Tubulipora Lamarck, 1816. Eocene (Midwayan)-Recent.
Platonea Canu and Bassler, 1920. Oligocene (Vicksburgian)-Recent.
Centronea Canu and Bassler, 1920. Eocene.
Idmonea Lamouroux, 1821. Cretaceous–Recent.
Idmidronea Canu and Bassler, 1920. Cretaceous, Eocene.
Mesonea Canu and Bassler, 1920. Eocene–Recent.
Pleuronea Canu and Bassler, 1920. Eocene–Pliocene.
Tretonea Canu and Bassler, 1920. Eocene.
Erkosonea Canu and Bassler, 1920. Eocene.
Tennysonia Busk, 1867. Recent.

Genus PLATONEA Canu and Bassler, 1920.

1920. *Platonea* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull, 106, U. S. National Museum, p. 759.

The type of this genus, *Reptotubigera phillipsae* Harmer, 1915, is an incrusting species with the ovicell spread out between the fascicles over the entire zoarial width. The following new species are interesting because they exhibit the same ovicell structures in the erect forms of growth. Under the old classification these two species and the incrusting type would be assigned to three quite different genera.

PLATONEA SCALARIA, new species.

Plate 11, figs. 1–5.

Description.—The zoarium has the *Idmonea* form of growth, somewhat enlarged at the bifurcations. The fascicles are salient, close together, alternate or opposite, formed of 3 or 4 tubes. The tubes are little distinct, hardly convex; the peristome is thin, orbicular or rectangular. The ovicell is large, convex, wide spread between the fascicles over the whole zoarial width; the oeciostone is elliptical, transverse, provided distally with a sort of raised lip, less wide than a tube, hardly salient and orthogonal.

Measurements.—	Zooecial diameter	0.20 mm.
	Width of fascicles	.25 mm.
	Distance between fascicles	.40 mm.
	Dimensions of oeciostome	.26 by 0.14 mm.
	Zoarial width	1.20 mm.

Variations.—This species is well characterized by its fascicles regularly arranged *according to scale* and quite close together, and also by the form of its ovicell. We have been rather fortunate in finding many ovicells and to recognize among them some variations. They are enlarged at the bifurcations. The oeciostome is absent or isolated or adjacent to a tube. In the last case the oeciostome is turned toward the bottom, although the orifice placed at the base of the peristomie must be in the habitual position. The form bent back toward the base of the oeciostome appears therefore to be due to the closeness of the distal tube.

Occurrence.—Sirun (Sulu Archipelago, Tawi Tawi group); Philippine Islands (*Albatross* station D. 5151).

Cotypes.—Cat. No. 7375, U.S.N.M.

PLATONEA HIRSUTA, new species.

Plate 11, figs. 6, 7.

Description.—The zoarium is a short, claviform *Filisparsa*. The tubes are little distinct, short, terminated by a very long peristomie, raised almost vertically. The ovicell is suborbicular, convex, subsymmetrical; the oeciostome is elliptical, transverse, subcentral, orthogonal.

Measurements.—	Diameter of tubes and of peristomes................	0.26 mm
	Dimensions of oeciostome....	.33 by 0.16 mm

The general aspect is quite irregular and does not permit of constant micrometric measurements; it appears like a club bristling with spines.

Occurrence.—Sirun (Sulu Archipelago, Tawi Tawi group); Philippine Islands (*Albatross* station D. 5151).

Holotype.—Cat. No. 7376, U.S.N.M.

Genus IDMONEA Lamouroux, 1821.

IDMONEA MAGNA Canu and Bassler, 1920.

Plate 8, fig. 11.

1920. *Idmonea magna* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 772, pl. 137, figs. 1–18.

This very abundant Early Tertiary bryozoan is an excellent example of the number of specimens which must be examined before an ovicell is discovered. In this case literally thousands of specimens were glanced over before the ovicelled one here figured was found. Fortunately the ovicell is not necessary in the identification of the species.

Occurrence.—Eocene (Jacksonian): Atlantic and Gulf States.

Genus PLEURONEA Canu and Bassler, 1920.

PLEURONEA FENESTRATA Busk, 1859.

Plate 10, figs. 1–5.

1920. *Pleuronea fenestrata* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 766, pl. 114, figs. 1–18 (bibliography and distribution).

We have had the good fortune to discover many ovicelled specimens of this species, whereby we were able to study its variations. They are as numerous as in the genus *Tubulipora.* The ovicell appears symmetrical and median (fig. 3) on certain specimens; in others, it is sometimes a little developed on one side (fig. 1); finally it may surround a part of the zoarium and be developed on the frontal (fig. 2).

The dorsal of this species presents the most varied aspects. We have discovered some specimens on which the tergopores open at the bottom of pseudosulci (fig. 5). These latter are branched, irregular, and undulate, in which they differ from true longitudinal sulci.

The genus *Pleuronea* resembles the genus *Crisina* D'Orbigny 1850 very much, but it differs in the presence of tergopores (and not vacuoles), in the quite different ovicell, and in its salient oeciostome.

Occurrence.—Eocene (Jacksonian) Jackson, Mississippi.

Plesiotypes.—Cat. No. 68934, U.S.N.M.

Genus TENNYSONIA Busk, 1867.

1867. *Tennysonia* BUSK, Zoophytology, Quarterly Journal Microscopic Science, vol. 7, p. 240, pl. 36.

Tubuliporidae bearing mesopores on the frontal.

Genotype.—*Tennysonia stellata* Busk, 1867. Recent.

TENNYSONIA STELLATA Busk, 1867.

Plate 11, figs. 8–10.

1875. *Tennysonia stellata* BUSK, Catalogue Marine Polyzoa in British Museum, pt. 3, Cyclostomata, p. 34, pl. 31, fig. 6.

We have not discovered the ovicell in this interesting generic type but have found it in the closely allied *Idmonea contorta* Busk. The internal structure of both these species is essentially as shown in the accompanying figures.

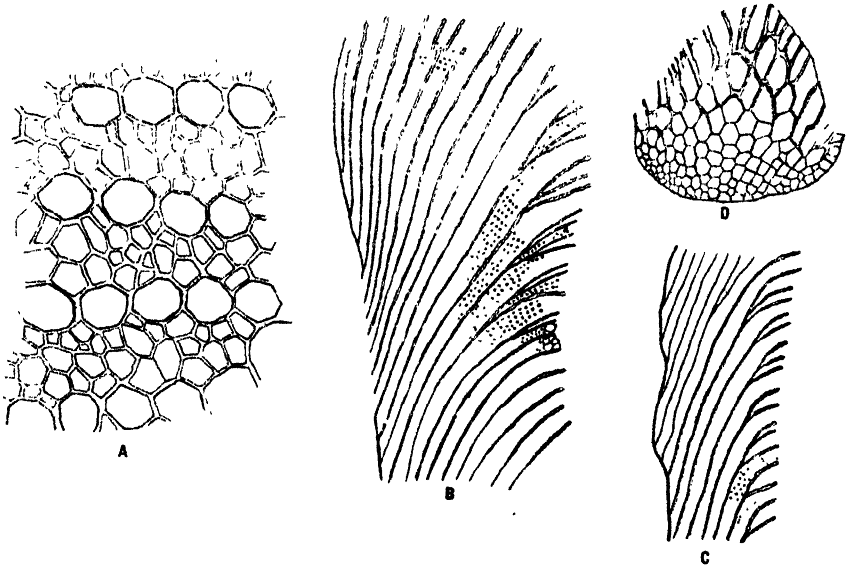


FIG. 9—Tennysonia stellata Busk, 1867.

A. Tangential section, × 25.

B, C. Two vertical sections, × 12, illustrating the thick basal lamella, the vesicular walls and the formation of the mesopores, as well as the minute pores of the walls.

D. Transverse section, × 12.

Recent: Port Elizabeth, South Africa.

Occurrence.—Recent: Algoa Bay and Port Elizabeth, South Africa.

TENNYSONIA CONTORTA Busk, 1875.

Plate 11, figs. 11–14.

1875. *Idmonea contorta* BUSK, Catalogue Marine Polyzoa in British Museum, pt. 3, Cyclostomata, p. 12, pl. 8.

1887. *Idmonea contorta* WATERS, Tertiary Bryozoa from New Zealand, (Cyclostomata) Quarterly Journal Geological Society, vol. 43, p. 339.

Measurements.—	Interfascicular distance (in rectilinear branches	0.20 mm.
	Width of fascicles	.12–0.18 mm.
	Diameter of salient peristomes	.12–0.16 mm.
	Diameter of larger zooecia	.20 mm.
	Maximum zoarial diameter	2.00 mm.
	Number of tubes to fascicle	7 to 8.

The specimens which we have studied were determined and sent to us by Miss Jelly. They are a little different from Busk's figured type, which does not show adventitious tubes, although, as shown on plate 11, figure 12, the mesopores are not always closed.

The fascicles are very salient and quite close together. Most often the first tube is the larger; rarely it is the second. The peristomes are not always adjacent; the first two or three only are joined together. The tubes are visible longitudinally on the posterior face of the zoarium, which is in addition striated transversally.

On the anterior face the two or three interfascicular mesopores are more often closed by a calcareous lamella, finely perforated.

The ovicell is large and finely punctated; it surrounds at least six fascicles over the whole width of the zoarium. The oeciostome appears to be a larger tube than the others; but we are not certain. One of our specimens is supported on a *Retepora* by very solid calcareous processes.

Occurrence.—Recent: Port Elizabeth, South Africa (Busk, Miss Jelly).

Family CYTISIDAE D'Orbigny, 1854.

The ovicell is a vesicle limited, elliptical, globular with special walls. It is parallel to the zooecial axis and formed after the consolidation of the subjacent peristomes.

Historical.—D'Orbigny, 1852 has classified the divers genera of this family in his two familites of the Cytisidae and Fascigeridae, according to the form of the tubes. This character was for him fundamental and characteristic. Pergens, 1889, adopted the classification of D'Orbigny. Gregory, 1909, has distributed the same genera in the three families of Osculiporidae Marsson, 1887, Zonatulidae Gregory, 1909, and Desmeporidae Gregory, 1909, according to the nature of the adventitious pores. Of all these names those of

D'Orbigny are the oldest; as all the genera of the Cytisidae are comprised in the family as here adopted we employ this name.

The study of this family shows that the mode of gemmation itself is not a family character as in the Cheilostomata.

The form of the apertura is a good generic character; it is certainly in rapport with the disposition of the tentacles and of the retractor muscles of the polypide. But the oblique and elongated form of *Cytis* and its allies is found again in other families and can not in any case be considered as an exclusive character.

DICHOTOMOUS KEY SHOWING STRUCTURE OF GENERA.

1.	Gemmation triparietal	*Cyrtopora.*
	Gemmation biparietal	2.
2.	Tubes with peristome	3.
	Tubes without peristomes	5.
3.	Tubes expanded, grouped in linear fascicles	*Discocytis.*
	Tubes cylindrical	4.
4.	Tubes grouped in linear fascicles on anterior face of zoarium	*Osculipora.*
	Tubes in orbicular zones around zoarium; nematopores	*Plethopora.*
	No adventitious pores	*Plethoporella*
5.	Tubes expanded neither mesopores nor nematopores.	*Homoeosolen.*
	Tubes cylindrical	6.
6.	Large ovicell, zoarium discoid	*Discocytis.*
	Small ovicell, zoarium arborescent	7.
7.	Vacuoles all around zoarium	*Desmepora.*
	Nematopores dorsal	8.
8.	Mesopores frontal	*Semicytis.*
	No frontal mesopores	9.
9.	One row of pinnules	*Unicytis.*
	Two rows of pinnules; one face smooth	*Truncatula*

KEY FOR DETERMINATION OF GENERA.

1.	Aperture orbicular	2.
	Aperture elongated, without peristome	5.
2.	Tubes in linear fascicles	3.
	Tubes grouped in orbicular zones	4.
3.	Tubes increasing from the dorsal to the frontal in transverse section (expanded tubes)	*Diplodesmopora.*
	Tubes of the same size in the transverse section (cylindrical tubes)	*Osculipora.*
4.	No adventitious pores	*Plethoporella.*
	Nematopores	*Plethopora.*
5.	Zoarium discoid	*Discocytis.*
	Zoarium arborescent	6.
6.	One face smooth	7.
	No face smooth	8.
7.	Convex face smooth, no nematopores	*Homoeosolen.*
	Concave face smooth, dorsal nematopores. Apertures at the extremity of the pinnules	*Truncatula.*
8.	One row of pinnules	*Unicytis.*
	Two rows of pinnules	9.
9.	Tubes on the trunk and on the pinnules. Frontal mesopores	*Semicytis.*
	Tubes at the extremity of the pinnules; vacuoles all around zoarium	*Desmepora.*

Genus CYRTOPORA Hagenow, 1851.

1851. *Cyrtopora* Hagenow, Die Bryozoen der Maastrichter Kreidebildung, p. 21.

The ovicell is an ovoid protuberance near the end of the zoarium (Gregory). The tubes are cylindrical short, with fasciculate peristomes; the gemmation is triparietal around a central bundle formed of three or four tubes.

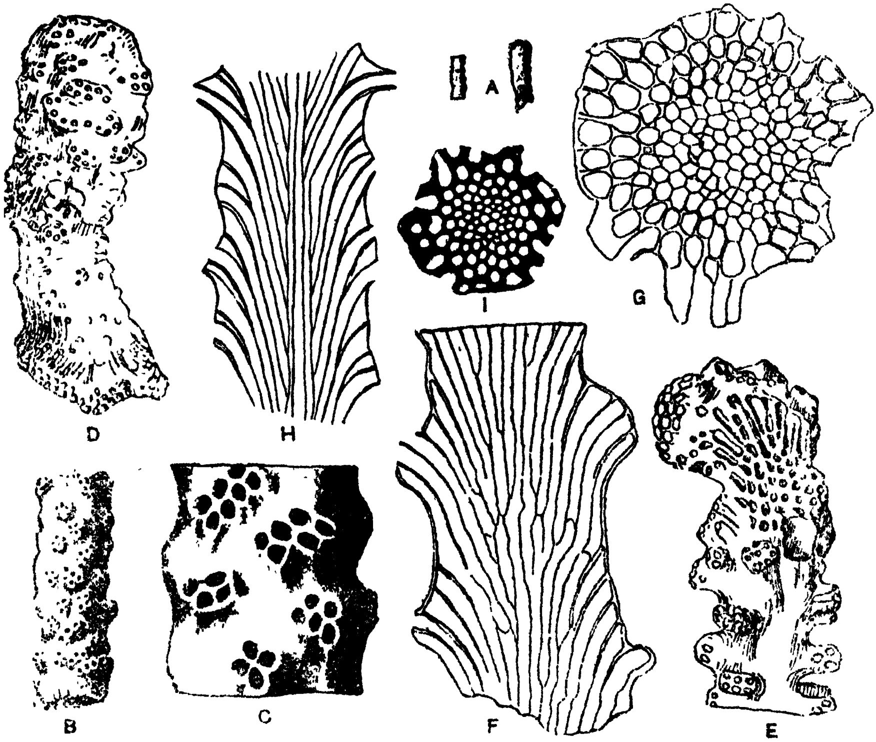


Fig. 10.—Cyrtopora elegans Hagenow, 1851.

A, B. Zoarium natural size and × 5.

C. A portion more enlarged. (A–C, after Hagenow.)

D. A small clavate zoarium, × 8, with slightly expanded base.

E. Upper part of a zoarium, × 8, with the ovicell developed.

F, G. Longitudinal and transverse sections, × 14 and × 18. (D–G, after Gregory.)

H. Longitudinal section, × 16, showing the cylindrical tubes with triparietal gemmation, arranged around a central bundle.

I. Transverse section, × 16, The tubes of the central bundle are wider than the adjacent ones.

Cretaceous (Maastrichtian): Maastricht, Holland.

Genotype.—Cyrtopora elegans Hagenow, 1851.

Affinities.—This genus is close to *Osculipora* in which the tubes are also cylindrical, short and fasciculated; it differs from it in the absence of nematopores and in the presence of an initial bundle (central in the present case) with long tubes.

Gregory's figure is not clear but it appears to us however to represent the habitual ovicell of the genera in the family Osculiporidae. We have discovered a specimen preserving a fragmentary ovicell which indicates this genus belongs to another family, possibly the Diaperoeciidae.

CYRTOPORA ELEGANS Hagenow, 1851.

1909. *Cyrtopora elegans* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, vol. 2, p. 53, figs. 18, 19, 20, 21 (Bibliography Geological distribution).

Structure.—In transverse section, there are three larger tubes at the center forming the central bundle. They are surrounded by smaller tubes representing the base of short tubes and characterizing the triparietal gemmation. In longitudinal section the tubes are irregular, in general aspect cylindrical but slightly widened towards their extremity. They are short and arranged around the central bundle formed of three long tubes branching at divers heights to engender new branches. Their gemmation is triparietal.

The number of tubes in the central bundle does not appear to be constant; on Gregory's figures there is only one central tube. With this difference they are identical with our specimens.

Occurrence.—Cretaceous (Maastrichtian). Maastricht, Holland.

Plesiotypes.—Cat. No. 98979, U.S.N.M.

Genus PLETHOPORA Hagenow, 1851.

1851. *Plethopora* HAGENOW, Die Bryozoen der maastrichter Kreidebildung, p. 45.

The tubes are cylindrical, without peristome, with orbicular orifice, grouped in salient bundles. The nematopores occur all around the zoarium.

Genotype.—*Plethopora verrucosa* Hagenow, 1851. Aptian- Maastrichtian.

Affinities.—Gregory, 1909, placed this genus in his family Zonatulidae. This is not natural as the structure of *Plethopora* is entirely different from that of *Zonatula* which we have figured in the family Ascosoeciidae. D'Orbigny, 1852, has correctly placed this genus with *Truncatula*, *Semicytis*, etc.

PLETHOPORA VERRUCOSA Hagenow, 1851.

1851. *Plethopora verrucosa* HAGENOW, Die Bryzoen der Maastrichter Kreidebildung, p. 45, pl. 5, fig. 10.

1851. *Plethopora truncata* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 46, pl. 5, fig. 11.

1909. *Plethopora verrucosa* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 228 (Bibliography, geologic distribution).

We have not yet discovered the ovicell of this species and following D'Orbigny, class the genus with *Truncatula*, *Semicytis*, etc. The internal structure will be figured in our next paper.

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland.

PLETHOPORELLA, new genus.

The ovicell is elliptical, elongated, large, little convex, smooth. The tubes are cylindrical, without peristome, with orbicular orifice; their walls are moniliform; they are curved at their extremity. The gemmation is peripheral around a bundle of axial tubes. No adventious tubes.

Genotype.—*Plethoporella* (*Plethopora*) *ramulosa* D'Orbigny 1847.

Range.—Campanian, Maastrichtian.

Historical.—D'Orbigny was in error in allying the genotype with *Plethopora verrucosa* Hagenow, 1851, for the internal structure is quite different since there are no nematopores and the tuberosities which ornament the zoarial surface are not bundles of tubes. Illustrations of the internal structure of the genotype will be given in our next publication on this subject.

PLETHOPORELLA RAMULOSA D'Orbigny, 1855.

Plate 23, figs. 12–16.

1855. *Plethopora ramulosa* D'ORBIGNY, Paleontologie Française, Terrain Crétacé, vol. 5, p. 1045, pl. 799, figs. 1–3.

A full description of this species is reserved for our next publication and we will only remark here that the internal structure is that of *Ceriopora* where we would have classed the species if we had not discovered the ovicell, which shows its relationship to the Cytisidae.

Occurrence.—Cretaceous (Campanian): Montmoreau, Brossac, Draullard, St. Aulais, Echebrune and Daviat (Charente), France.

Cretaceous (Maastrichtian): Royan (Charente inferieure), Manie Roux and St. Lheurine (Dordogne), France.

Plesiotypes.—Canu collection and Cat. No. 68980, U.S.N.M.

Genus OSCULIPORA D'Orbigny, 1849.

1849. *Osculipora* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 6.

The ovicell is globular, limited more or less salient, placed on the frontal or on the dorsal. The tubes are cylindrical, fasciculated, with peristomes in linear fascicles; the gemmation is dorsal in each fascicle, and peripheral at the plane of each fascicle. The zoarium has no basal lamella; it bears on the dorsal a wall formed of short nematopores with very thick walls.

Genotype.—*Osculipora* (*Retepora*) *truncata* Goldfuss, 1827 (pl. 23, figs. 1–6).

Range.— Cretaceous (Campanian-Danian.)

The known species belonging to this genus in addition to the genotype are:

Osculipora repens Hagenow, 1851. Maastrichtian, Danian.
Osculipora houzeaui Pergens, 1894. Maastrichtian.
Osculipora royana D'Orbigny, 1850. Maastrichtian, Campanian.

Affinities.—The place of the ovicell is not constant; it may be lateral, frontal, or dorsal; but the nature of the tubes is always the same. Exteriorly this genus very much resembles *Diplodesmopora;* it differs from it in its cylindrical and nonwidened tubes. It differs from *Desmepora* Lonsdale, 1850, in the absence of adventitious pores on the frontal and in its cylindrical tubes.

OSCULIPORA REPENS Hagenow, 1851.

Plate 23, fig. 7.

1851. *Truncatula repens* HAGENOW, Die Bryozoen der Maastrichter Kreidebildng, p. 36, pl. 3, fig. 1.
1909. *Osculipora repens* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 61, figs. 22, 23 (Bibliography).

Structure.—We have not enough specimens of the genotype to make sections, but there is no doubt of the generic identity of the present species with the genotype. However the ovicell is placed here on the frontal between the fascicles; it is less globular than in the other species.

In transverse section the tubes are almost of the same size; they are therefore cylindrical; the walls of the exterior tubes are thick. The dorsal wall of the zoarium is very thick and perforated by small pores corresponding to the nematopores. When the transverse section is made at the level of the fascicles, these appear cylindrical.

In longitudinal section the tubes are cylindrical, fasciculated with adjacent peristomes; they are separated by a small interzooecial canal. They bifurcate at all heights and in the vicinity of the dorsal. The tubes of the same fascicle grow successively by dorsal gemmation. The nematopores are short; their walls are very thick in the branches, but they are much less so at their extremity.

The posterior face (dorsal) is smooth and covered by a very thin epitheca; this disappears at the least wear and the nematopores appear; they are directed from below upward according to the rule of their formation. Gregory 1909 has made the same observation in *Osculipora truncata* Goldfuss, 1827.

Affinities.—This species differs from *Osculipora truncata* in the wider zoarium, the transverse fascicles (and noncylindrical) and in the more scattered fascicles.

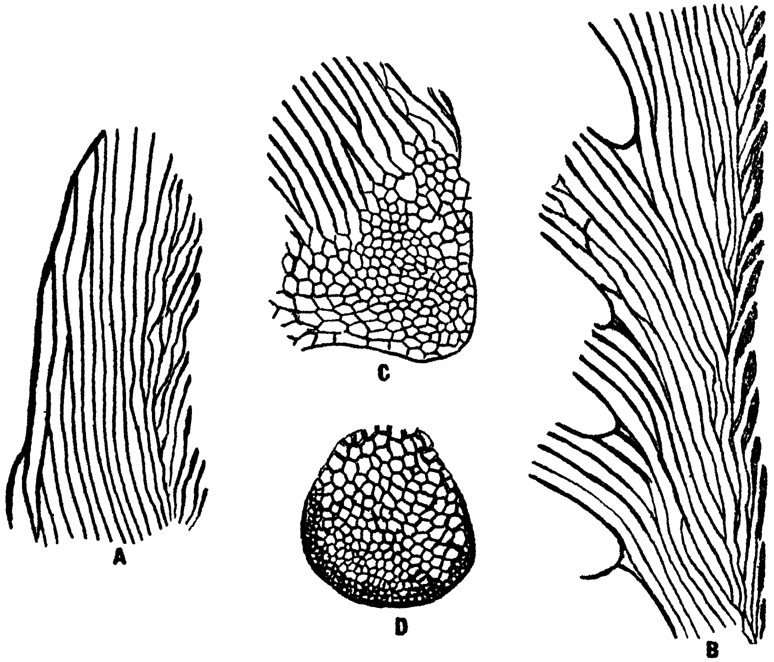


Fig. 11.—Osculipora repens Hagenow, 1851.

A. Longitudinal section, × 16, through the end of a branch.

B. Longitudinal section, × 16, through a well-developed branch showing the greatly thickened nematopores to the right and the tubes of several pinnules to the left.

C. Transverse section, × 16, through the middle of a fascicle.

D. Transverse section, × 16, cutting a branch just below a fascicle.

Cretaceous (Maastrichtian): Maastricht, Holland.

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland; Royan, France.

Plesiotypes.—Canu collection and Cat. No. 68981, U.S.N.M.

OSCULIPORA ROYANA D'Orbigny, 1853.

Plate 23, figs. 10, 11.

1853. *Osculipora royana* D'Orbigny, Paléontologie française, Terrain Crétacé, vol. 5, p. 679, pl. 800*bis*, figs. 1–4.

1909. *Osculipora royana* Gregory, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 66 (Bibliography).

Affinities.—This species is well described by D'Orbigny but the ovicell has never been figured. The specimens found by Canu in the same locality (Royan) have been compared with those in the Museum of Natural History of Paris; they are ovicelled. The ovicell is placed laterally on the zoarium. It is limited, smooth, very globular.

This species differs from *Osculipora truncata* Goldfuss, 1827, in which the branches are also cylindrical, in its transverse (and not cylindrical) fascicles which are closer together. It differs from *Osculipora repens* Hagenow, 1851, in its cylindrical branches, its fascicles much closer together, and its ovicells placed laterally. The branches are not always as slender as those studied by D'Orbigny, as we have some which are very vigorous.

Occurrence.—Cretaceous (Campanian): Montmoreau (Charente), France.

Cretaceous (Maastrichtian): Royan (Charente Inferieure), France.

Plesiotype.—Canu collection and Cat. No. 68982, U.S.N.M.

DIPLODESMOPORA, new genus.

Greek, *Diplos*, double; *desmos*, fascicle. Alluding to the double row of tubes in the fascicles.

The ovicell is limited, globular, smooth, margined, placed laterally. The tubes are funnel shaped, fasciculated, with peristomes in linear fascicles; they grow by dorsal gemmation. The zoarium has no basal lamella, but it has a thick dorsal covering formed of nematopores with thick walls.

Genotype.—*Diplodesmopora opposita*, new species. Coniacian, Maastrichtian.

Affinities.—Exteriorly this genus much resembles *Bitubigera* D'Orbigny, 1851, in which, however, the ovicell is not known. It differs from it in its widened tubes (club shaped and not cylindrical) and in the presence of nematopores instead of tergopores. The presence of nematopores gives a conical aspect to the zone of growth, a character which does not exist in *Idmonea.*

In its biserial fascicles and its nematopores *Diplodesmopora* resembles the genus *Osculipora* D'Orbigny, 1849, but differs from it in its widened and not cylindrical tubes.

Certain branches are exactly like those of *Idmonea* or *Idmidronea.* These zoarial forms are quite common and observable in different families. The ovicell is totally different from that of the genus *Idmonea* as it is now maintained. Moreover the dorsal nematopores are adventitious tubes absolutely contrary to the firmatopores of *Idmidronea.* They are buried in the epitheca, but they are open and visible in the zone of growth at the end of the branches.

The genus differs from *Truncatula* Hagenow, 1851, which is also provided with nematopores by its tubes with peristomes and grouped in fascicles and not in pinnules.

DIPLODESMOPORA OPPOSITA, new species.

Plate 27, figs. 19–25.

Description.—The zoarium is free, linear, with triangular section, with bifurcated branches. The fascicles are salient, monoserial or biserial, opposite, arranged on each side of the median crest. The tubes are visible; the peristomes are thin and quadrangular. The ovicell is quite large, elliptical, elongated, placed laterally in the vicinity of the fascicles, smooth and globular.

Measurements.—	Diameter of peristomes	0.08 mm.
	Separation of fascicles	.40 mm.
	Diameter of branches	1.33 mm.

Variations.—The fascicles are often monoserial and the branches have absolutely the aspect of *Idmonea*, but more often the fascicles are biserial and formed of a dozen tubes.

The ovicell is very regular, margined by a sort of collar; it does not grow from a tube of a fascicle, but from a more lateral tube and is placed between two fascicles.

A thin epitheca covers the nematopores; the dorsal then appears smooth. At the least weathering the nematopores appear in their usual occurrence from below upward.

In transverse section the tubes are smaller in the vicinity of the dorsal and correspond to the funnel-shaped tubes. The dorsal is very thick and perforated by pores corresponding to the nematopores. The section is more or less triangular, according to the place where it is made.

The longitudinal section is quite regular. The tubes are long, funnel shaped with dorsal gemmation. They are ramified in long, rectilinear dorsal nematopores with very thick walls.

Occurrence.—Cretaceous (Coniacian): Tours and Ste. Paterne (Indre-et-Loire), France.

Cotypes.—Canu collection and Cat. No. 68983, U.S.N.M.

DIPLODESMOPORA ALTERNATA, new species.

Plate 27, figs. 12–18.

Description.—The zoarium is idmoneiform, free with a subtriangular section. The linear bundles are salient, uniserial, formed of 3 or 4 tubes and disposed alternately on each side of the median crest The tubes are visible, little convex; the peristome is thin. The ovicell is very convex, slightly elongated, smooth, placed on the side of the zoarium. The noncellular face is smooth and the nematopores are closed by a very thin pellicle.

Measurements.—	Diameter of fascicles	0.18 mm.
	Distance of fascicles	.25–0.30 mm.
	Diameter of peristome	.13 mm.
	Width of zoarium	1.00 mm.

Affinities.—Without the ovicell this species can be confounded with *Idmonea*, because there is no exterior mark of difference. The dorsal is smooth because the nematopores are closed by a thin calcareous pellicle, longitudinally striated. The zone of growth is conical and shows the orifices all around the zoarium. It reveals also exteriorly the presence of nematopores. This character does not exist in *Idmonea.*

The alternate arrangement of the fascicles distinguishes this species from *Diplodesmopora opposita.*

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland.

Cotypes.—Canu collection and Cat. No. 68984, U.S.N.M.

Genus HOMOEOSOLEN Lonsdale, 1850.

1850. *Homoeosolen* LONSDALE, in Dixon's Geology and Fossils of the Tertiary and Cretaceous formations of Sussex, p. 307.

The ovicell is frontal, elliptical, elongated, more or less globular. The tubes are long, widened (club-shaped) oriented with dorsal gemmation, with terminal walls a little thickened, without peristome, with oblique orifice, grouped in branches with pinnules. The peristomes are distributed on the trunk of the branches and on the pinnules. The dorsal is smooth; it is turned to the exterior of the bushy zoaria. No adventitious tubes.

Genotype.—*Homoeosolen ramulosus* Lonsdale, 1850.

Structure.—The very simple and monomorphic structure of this genus was discovered by Gregory. Unfortunately he has classified in it some species much more complicated.

Affinities.—This genus differs from *Truncatula* Hagenow, 1851, in the absence of dorsal nematopores. It differs from *Semicytis* D'Orbigny, 1854, in the absence of frontal mesopores.

HOMOEOSOLEN RAMULOSUS Lonsdale, 1850.

Plate 24, figs. 8–14.

1909. *Homoeosolen ramulosus* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 76, figs. 26, 27, pl. 3, fig. 7; pl. 4, fig. 2. (Bibliography, Geologic Distribution.)

1900. *Truncatula aculeata* CANU, Contributions a la Geologie de Romorantin, Bulletin Société Géologique de France, ser. 3, vol. 28, p. 193.

Structure.—Gregory's longitudinal section made at the extremity of a branch does not sufficiently indicate the true nature of the tubes. Ours is more complete. The tubes are widened, long and their terminal walls are a little thickened. The dorsal wall is very thick so that the mode of gemmation does not appear clearly and the dorsal appearance is perhaps only the result of the orientation of the tubes turned in a single direction.

The tubular orifices have no very special form; they are directed obliquely toward the top. They are distributed at the same time, on the zoarial trunk and pinnules; the latter are very irregular never symmetrically arranged and are transformed into true branches in most cases.

Affinities.—This species differs from *Homoeosolen gamblei* Gregory, 1909, in the absence of pinnules symmetrically arranged and in its ovicell more globular and not occupying the entire width of the zoarium.

The base is discoidal; it is attached to algae or on other bryozoa. The zoarium is somewhat bushy. On our specimens the cellular face is on the interior and the smooth face is at the exterior of the zoarium, contrary to that shown on Gregory's figures. The disk is partially or entirely covered with pores.

The noncellular or inferior face is not a basal lamella formed by the dorsal of the newly budding tubes. It appears to be formed in the same manner as the Frondiporidae by the dorsal of interior tubes budding anteriorly. But this observation requires further examination.

Occurrence.—Cretaceous (Turonian): Riou (Indre-et-Loire), France.

Cretaceous (Santonian): Romorantin (Loir-et-Cher), France.

Cretaceous (Campanian) La Bonneville (Seine-et-Oise), France.

Plesiotypes.—Canu collection and Cat. No. 68985, U. S.N.M.

HOMOEOSOLEN GAMBLEI Gregory, 1909.

Plate 24, figs. 1–7.

1909. *Homoeosolen gamblei* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 84, fig. 28. (Bibliography. Geological distribution).

1854. *Truncatula carinata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1058, pl. 797, figs. 11–15 (not figs. 5–10).

1897. *Truncatula aculeata* CANU, Bryozoaires du Turonian de St. Calais, Bulletin Société Géologique de France, ser. 3, vol. 25, p. 748.

1903. *Truncatula tetragona* CANU, Note sur la constance de la Craie de Villedieu, Bulletin Société Géologique de France, ser. 4, vol. 3, p. 268.

Structure.—The ovicell is placed on the anterior face but always in an excentric manner; its large axis is never parallel to the zoarial axis. It is elliptical, convex, margined, smooth or wrinkled, and often surmounted by a peristome larger than the others.

The longitudinal section is identical with that of *Homoeosolen ramulosus*. There is only one kind of tube; they are widened and their upper walls are little thickened. They have no peristome and open obliquely. The entire cellular face and the pinnules are covered by the orifices of the polypidian tubes. There are no accessory or adventitious pores.

The meridian section figured by Gregory indicates the habitual lozenge-shaped areas of the dorsal gemmation.

Affinities.—This species differs from *Homoeosolen ramulosus* Lonsdale, 1850, in the presence of its symmetrically arranged pinnules. It differs from the species of *Truncatula* with which Canu has confused it in the absence of nematopores and in the presence of the apertures over the entire zoarial surface and not at the extremity of the pinnules alone.

Occurrence.—Cretaceous (Turonian): Conneré, Dunneau, and St. Calais (Sarthe), France.

Cretaceous (Coniacian): Villedieu and Lisle (Loir-et-Cher) and Les Phellipeaux (Charente), France.

Plesiotypes.—Canu collection and Cat. No. 68986, U.S.N.M.

Genus TRUNCATULA Hagenow, 1851.

1851. *Truncatula* HAGENOW, Die Bryozoen des Maastrichter Kriedebildung, p. 34.

The ovicell is placed on the dorsal, laterally and between two pinnules. The tubes are cylindrical, oriented, with dorsal gemmation; the apertures are elongated, oblique, without peristomes, grouped at the extremity of the pinnules and turned from the side of the dorsal. The nematopores are numerous, long, with thick walls, they are often closed by a calcareous pellicle; their ensemble forms a thick wall on the zoarium.

Genotype.—*Truncatula filix* Hagenow, 1851.

Range.—Cenomanian-Maastrichtian.

Historical.—D'Orbigny, 1852, has noted that Hagenow's *Trunculata* in most instances corresponds exactly to his *Osculipora*, but, noting that *Truncatula filix* was not an *Osculipora*, he maintained Hagenow's genus of which this species ought to be the genotype; unfortunately it is rare and has not yet been the object of special studies.

Gregory, 1909, confusing the orifices of the nematopores with those of the tubes, classified the species of this genus in *Homoeosolen* Lonsdale, 1850. The considerable difference between the sections does not permit this conclusion. Evidently the exterior appearance is very deceiving, the orifices of the nematopores being hardly different from those of the tubes; but the well preserved specimens shows the nematopores closed by a calcareous pellicle, and the longitudinal sections reveal nematopores which do not exist in *Homoecosolen*.

Affinities.—This genus differs from *Homoeosolen* Lonsdale, 1850, in the presence of nematopores, in the occurrence of apertures only at the extremity of the pinnules, and in its ovicells placed on the dorsal. It differs from *Osculipora* D'Orbigny, 1849, in its tubes without peristome and in the presence of pinnules and not of fascicles.

The zoarium is more or less bushy; the dorsal is exterior, the frontal which is smooth is interior; the apertures are open from the exterior side, that is to say, from the side of the dorsal with nematopores. In this arrangement the zoarium is not a trap for diatoms and its architecture appears to be hydrostatic.

TRUNCATULA FILIX Hagenow, 1851.

Plate 25, figs. 6, 7.

1851. *Truncatula filix* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 35, pl. 3, fig. 4.
1909. *Osculipora filix* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, vol. 2, p. 64, figs. 24, 25.

The zoarium of this species is quite simple, consisting of a stem rising from a sole-like base. A strong smooth midrib occurs on the celluliferous side. The ovicell has been figured by Gregory, whose figures we copy here.

Occurrence.—Cretaceous (Maastrichtrian): Maastricht, Holland.

TRUNCATULA PINNATA Roemer, 1840.

Plate 25, figs. 1, 2.

1840. *Idmonea pinnata* ROEMER, Die versteinerungen des norddeutschen Kreidegebirges, p. 20, pl. 5, fig. 22.
1846. *Idmonea pinnata* MICHELIN, Iconographie zoophytologie, p. 203, pl. 52, fig. 9.
1846. *Idmonea aculeata* MICHELIN, Iconographie zoophytologie, p. 203, pl. 53, fig. 10.
1854. *Truncatula aculeata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1054, pl. 796, fig. 1-5.
1871. *Truncatula pinnata* SIMONOWITCH, Beitrage zur Kenntniss der Bryozoen des Essener Grünsandes, Verhandlungen des Naturhistorischen vereins der preussischen Rhinlande und Westphalens, vol. 28 (ser. 3, vol. 8), p. 58, pl. 4, fig. 1.
1872. *Truncatula aculeata* REUSS, Die Bryozoen und Foraminiferen des unteren Planers, Paleontographica, vol. 20, pp. 98, 122, pl. 30, fig. 4.
1909. *Homocosolen pinnatus* GREGORY, Catalogue of Fossil Bryozoa in British Museum, Cretaceous, p. 69. (Bibliography.)

Affinities.—The ovicells are often larger than those figured by Simonowitsch and D'Orbigny; even their place is irregular as is indicated in our figured specimens.

The species differs from *Truncatula subpinnata* D'Orbigny, 1854, in its nematopores never closed, more numerous, smaller, and in which the orifice is quite oblique on the zoarial axis, and in its zoarial dimensions at least twice as large. It differs from *Truncatula tetragona* Michelin, 1846, in the orifice of the nematopores, which is larger, not elongated like a whistle, with a proximal transverse lip.

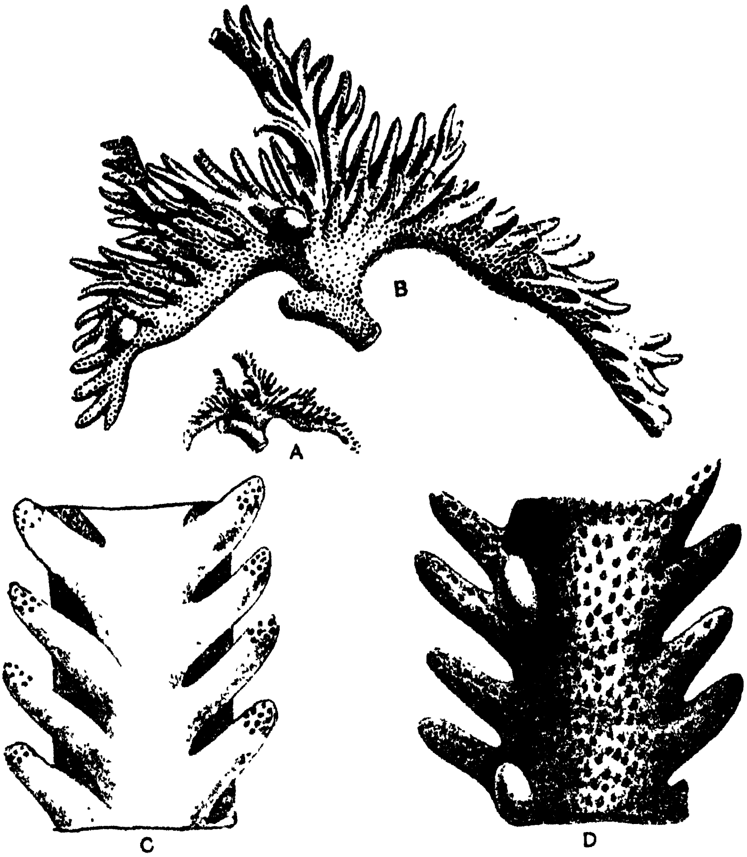


FIG. 12.—Truncatula pinnata Roemer, 1840.

A, B. Zoarium natural size and enlarged showing the base. The dorsal is exterior and covered with nematopores.

C. Frontal or inner face, enlarged.

D. Dorsal side, enlarged, showing ovicells and nematopores. (A, B, after D'Orbigny; C, D, after Simonowitsch.)

Cretaceous of France and Germany.

Occurrence.—Cretaceous (Cenomanian) Le Mans (Sarthe), France.

Geological distribution.—Cenomanian of France (D'Orbigny) England, Germany (Reuss); Turonian of Germany (Reuss).

Plesiotypes.—Canu collection and Cat. No. 68987, U.S.N.M.

TRUNCATULA SUBPINNATA D'Orbigny, 1854.

Plate 25, figs. 3–5.

1854. *Truncatula subpinnata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1055, pl. 796, figs. 6–9.
1889. *Truncatula subpinnata* PERGENS, Révision des Bryozoaires du Crétacé figurés par d'Orbigny, Mémoires de la Société Belge de Géologie de Paléontologie et d'Hydrologie, vol. 3, p. 385.

Structure.—We have found very beautiful specimens which have permitted us to study the structure. The nematopores are often closed by a calcareous pellicle, they are large, elongated, and parallel to the zoarial axis. The ovicell is globular, margined, and smooth.

In transverse section the tubes are much smaller toward the dorsal; they are then enlarged and with dorsal gemmation; the dorsal is thick and perforated with nematopores.

In longitudinal section the tubes are club shaped with dorsal gemmation. The nematopores are long, with thick walls; they form a thick zoarial wall by their consolidation.

The apertures are little visible on the frontal; they open chiefly on the dorsal and along the entire length of each pinnule. The zoarial base is a small flat disk twisted like a crank.

Affinities.—This species differs from *Truncatula pinnata* Roemer, 1840, in its smaller zoarial dimensions and in its dorsal ribs, in its nematopores larger and arranged parallel to the zoarial axis (and not obliquely) and in its more globular ovicell.

It differs from *Truncatula tetragona* Michelin, 1846, in its small zoarial dimensions, its less numerous nematopores arranged parallel to the zoarial axis.

Occurrence.—Cretaceous (Cenomanian): Le Mans (Sarthe), France. Cretaceous (Turonian); Duneau and Conneré (Sarthe), France.

Plesiotypes.—Canu collection and Cat. No. 68988, U.S.N.M.

TRUNCATULA TETRAGONA Michelin, 1846.

Plate 26, figs. 8–11.

1846. *Idmonea tetragona* MICHELIN, Iconographie zoophytologique, p. 219, pl. 53, fig. 19.
1854. *Truncatula tetragona* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1056, pl. 796, figs. 10–14.
1889. *Truncatula tetragona* PERGENS, Révision des Bryozoaires du Crétacé figurés par d'Orbigny, Memoires de la Société Belge de Géologie de Paléontologie et Hydrologie, vol. 3, p. 385.
1897. *Truncatula tetragona* CANU (not Canu 1900 and 1903), Bryozoaires du Turonian de St. Calais, Bulletin Société Geologique de France, ser. 3, vol. 25, p. 748.
1909. *Homoeosolen tetragonus* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 72 (not synonymy).

Structure.—In longitudinal section the tubes are cylindrical with dorsal gemmation occurring on a thick layer of nematopores. The latter are long, rectilinear with very thick walls. The section in this species is absolutely identical with that of *Truncatula subpinnata* D'Orbigny, 1854. In transverse section the dorsal is very thick and perforated by nematopores. The tubes are quite numerous, small; their diameter increases toward the frontal; the smallest pores are the nematopores. The meridian section shows the normal development of the tubes above the layer of nematopores in the axis of the

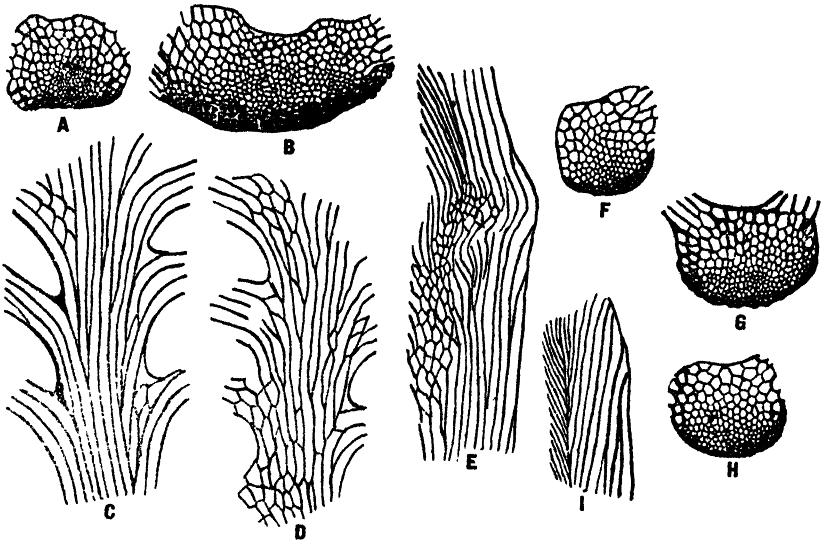


FIG. 13.—A–E. Truncatula tetragona Michelin, 1846.

A. Transverse section, × 12, cutting the narrowest part of a branch between two pinnules and showing the tetragonal form.

B. Transverse section, × 12, passing just below a pinnule.

C. A meridian section, × 12, cutting the axis of development and showing the central tube.

D. Meridian section, × 12, through the dorsal, cutting the young stages of the nematopores, the tubes of which are indicated by the lozenge-shaped areas.

E. Longitudinal section, ×12, through a branching specimen in which the lozenge-shaped areas indicate the point of bifurcation The dorsal with its nematopores is to the left.

Cretaceous (Turonian): Ruillé Poncé (Loir-et-Cher), France.

F–I. Truncatula subpinnata D'Orbigny, 1854.

F–H. Three transverse sections, × 12, at different heights in the branch and showing the thick dorsal zone penetrated by the nematopores.

I. Longitudinal section, × 12, illustrating the structure of the dorsal with its nematopores to the left, and the frontal to the right.

Cretaceous (Cenomanian): Le Mans (Sarthe), France.

zoarium. The tubes are cylindrical and proceed from a ramification opposite a preceding pinnule. At the center there is a longitudinal axial tube.

Affinities.—D'Orbigny's figure is quite exact and should cause no confusion, so it is without reason that Pergens and Gregory have identified this species with *T. subpinnata* D'Orbigny, 1854. It differs from it in its greater zoarial dimensions, in its smaller pinnules projecting little from the zoarial trunk and in its nematopores obliquely arranged (and not parallel) to the zoarial axis.

Its difference from *Truncatula pinnata* Roemer, 1840, which is also a large species, is more difficult to discover, and there are some very difficult cases to determine, but it differs from it in the aspect of the nematopores, which are arranged in rows oblique to the zoarial axis and which bear a proximal transverse lip, and in its smaller pinnules, less projecting on each side of the zoarial trunk.

Occurrence.—Cretaceous (Cenomanian): Le Mans (Sarthe) and Montlouet (Maine-et-Loire); France.

Cretaceous (Turonian): Fontaine d'Antoigné near Chatellerault (Vienne), Ruillé Poncé (Loir-et-Cher), Cément near Chinon (Indre-et-Loire), Les Janièrès and St. Calais (Sarthe), France.

Cretaceous (Coniacian): Chatham, England.

Plesiotypes.—Canu collection and Cat. No. 68989, U.S.N.M.

TRUNCATULA GRACILIS D'Orbigny, 1854.

1854. *Truncatula gracilis* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1059, pl. 798, figs. 1–5.

1909. *Homoeosolen striatus* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 97. (Bibliography.)

Gregory, 1909, identified D'Orbigny's species with *Retepora striata* Hagenow, 1846. This is quite possible, but no direct comparison having been made, we think that the better figure should have provisional priority.

Occurrence.—Cretaceous (Coniacian): Lisle (Loir-et-Cher), France.

Cretaceous (Santonian): Romorantin (Loir-et-Cher), France.

Cretaceous (Maastrichtian): Manie Roux (Charente) and Royan (Charente Inférieure), France.

TRUNCATULA CARINATA Reuss, 1846.

1846. *Hornera carinata* REUSS, Die Versteinerungen der böhmischen Kreideformation, pt. 2, p. 63, pl. 14, fig.6.

1909. *Homoeosolen carinatus* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 73.

Structure.—Gregory, 1909, wrote on page 75 "Pocta (op. cit. p. 7, fig. 3) gives an excellent transverse section (×26) showing the intimate structure of the species. The stem is strengthened front and back by a layer of laminated tissue, which does not appear to have any cancelli." In Pocta's figure the nematopores (cancelli of Gregory) are, on the contrary, quite visible. This species is therefore a *Truncatula* and not a *Homoeosolen.*

Affinities.—This is a small species like *Truncatula subpinnata* D'Orbigny, 1854, with which it is perhaps identical. In the figures it differs only in the smaller ovicell and in smaller and more numerous nematopores.

Occurrence.—Cretaceous (Cenomanian): Bohemia, Saxony, and England.

TRUNCATULA DISCOIDEA, new species.

Plate 25, fig. 9–11.

Our figures represent a unique specimen which might possibly belong to some known arborescent species. Having no specimens showing such a relation, we think that it should be given a new name, although we are not yet convinced that it is more than a simple zoarial base.

In spite of external appearances this is not a *Supercytis*, for the ovicell is indeed on the dorsal between the branches, as in all the species of the genus *Truncatula. T. subpinnata* D'Orbigny, 1854, appears to have tendencies to group its pinnules in a similar position.

Occurrence.—Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

Holotype.—Cat. No. 68990, U.S.N.M.

TRUNCATULA VENDOCINENSIS, new species.

Plate 26, figs. 12–16.

Description.—The zoarium is borne on an expanded circular base. The fronds are large, smooth, rectilinear, bifurcated; the transverse section is trapezoidal. The tubes are cylindrical, without peristome, grouped into pinnules, open at the extremity of the pinnules and on the posterior face. On the posterior face of the zoarium there are numerous nematopores, small, irregular, disposed in quincunx in the form of a V.

Structure.—The sections of this species are identical with those of *Truncatula tetragona* Michelin, 1846. The meridian section shows cylindrical tubes and an axial tube. The longitudinal section shows a thick layer of nematopores with very thick walls. Finally the transverse section is trapezoidal and shows the posterior zone of nematopores and the anterior zone of polypidian tubes.

Affinities.—This species differs from *Truncatula tetragona* Michelin, 1846, which it very much resembles in the great separation of the pinnules, in the great divergence of the pinnules, spreading out over the zoarial trunk, in the larger number of nematopores, and in the greater zoarial dimensions.

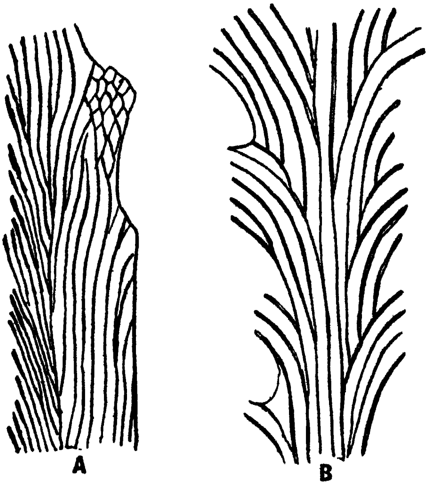


Fig. 14. Truncatula vendocinensis, new species.

A. Longitudinal section, × 16, showing the thick walled nematopores of the basal surface, to the left.

B. A meridian section, × 16, passing through the pinnules on each side.

Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

Occurrence.—Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

Cotype.—Canu collection and Cat. No. 68991, U.S.N.M.

Genus DISCOCYTIS D'Orbigny, 1854.

1854. *Discocytis* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1061.

The ovicell is ovoid, very large, placed exteriorly between two pinnules. The tubes are subcylindrical and long, without peristome, with elongated orifice, opening at the extremity of the pinnules and from the exterior side. The dorsal (exterior face) is surrounded by a thick layer of nematopores with thick walls. The cupuliform zoarium consists of a flat base with a narrow peduncle, and a broad cup shaped or funnel shaped head, which is composed of numerous radiating bundles (=pinnules) of zooecia.

Genotype.—*Discocytis* (*Pelagia*) *eudesi* Michelin, 1844.

Range.—Cenomanian-Campanian.

Affinities.—*Discocytis* is a discoidal *Truncatula*, but it differs in its much larger ovicells and in its subcylindrical tubes.

The genus *Bicavea* D'Orbigny, 1853, presents also a cupuliform or discoidal zoarium with zooecia grouped in radial bundles. Unfortunately the ovicell is unknown, and we are not able to find specimens to make the necessary sections.

DISCOCYTIS EUDESI Michelin, 1844.

Plate 28, figs. 10–15.

1844. *Pelagia eudesi* MICHELIN, 1844, Iconographie zoophytologique, p. 123, pl. 32, fig. 5.

1909. *Discocytis eudesi* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 100 (Bibliography, geological distribution.)

Structure.—The characteristic of the species is the extraordinary size of the ovicells, which measure from 1.5 mm. to 2 mm. in length.

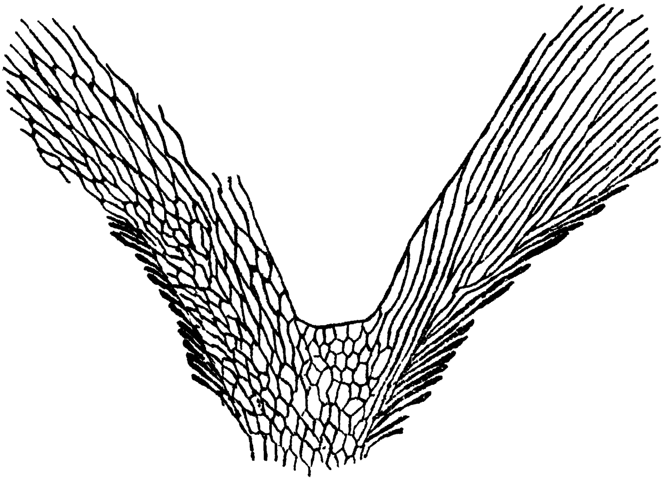


FIG. 15.—Discocytis eudesi Michelin, 1844.

Longitudinal (median) section through a zoarium, × 12, passing through the middle of a pinnule on the right and between two pinnules on the left. The thick walled nematopores of the basal surface are quite evident.

Cretaceous (Cenomanian): Le Mans (Sarthe), France.

We have counted as many as 10 on the same specimen. This very unusual fecundity accounts for the great number of specimens which have been found and which occur in all the museums of Europe. In spite of its fecundity, the species has not a great geographic extension, but remains restricted to the French Cenomanian.

The median section taken between two pinnules shows a series of elongated or spindle-like lozenge shaped areas; they result from the divergence of the tubes directed toward the adjacent pinnules. The median section made on a pinnule gives the longitudinal section; it is analogous to that of *Truncatula.* The tubes are subcylindrical, widened toward their extremity, and open on the two faces inferior and superior of the pinnule. The nematopores completely surround the base of the zoarium; their orifice is much smaller than that of the tubes.

Occurrence.—Cretaceous (Cenomanian; Le Mans (Sarthe), France.

Plesiotype.—Canu collection and Cat. No. 689921, U.S.N.M.

DISCOCYTIS? ECCENTRICA Ulrich and Bassler, 1907.

Plate 28, fig. 16.

1907. *Discocytis eccentrica* ULRICH and BASSLER, Bryozoa in Cretaceous Paleontology of New Jersey, p. 326, pl. 22, figs. 16–19.

We have been fortunate enough to discover the ovicell of this charming cupuliform and pedunculated species. It is a vesicle placed on the edge of the zoarium, of which it arrests the development and which ramifies between the fascicles. It is limited, smooth, little convex, and provided with special walls.

This species is therefore not at all a *Discocytis.* We maintain it provisionally in this genus, for the number of specimens collected does not permit us to make sections and to establish the nature of the tubes and adventitious pores. Perhaps it will be necessary to classify it in *Bicavea* D'Orbigny, 1854, a genus in which the ovicell is still unknown.

Occurrence.—Cretaceous (Vincentown marl): Vincentown. New Jersey.

Cotypes.—Cat. No. 52592, U.S.N.M.

Genus SUPERCYTIS D'Orbigny, 1854.

1854. *Supercytis* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1060.

Colony fastened at the base, where part of a cylindrical rather short peduncle is widened rather abruptly above, giving rise to simple or bifurcated branches, diverging horizontally, but joined at their base. Each of these branches is short, depressed, covered below by a thin epitheca and above by oblique, pyriform cellules. In the middle of the colony, above, may often be noted one or two ovarian vesicles, smooth, oval, semiconvex, and having within a canal which communicates with the interior of the colony. (Translation after D'Orbigny, 1854.)

Genotype.—*Supercytis digitata* D'Orbigny, 1854. Coniacian.

Gregory, 1909, identified doubtfully the genotype with *Homoe-*

osolen ramulosus Lonsdale, 1850. The ovicell not being placed on the branches as in *Homoeosolen*, we believe that D'Orbigny's genus ought to be maintained. The discovery of new material alone will enable us to establish its reality.

SUPERCYTIS DIGITATA D'Orbigny, 1854.

Plate 27, figs. 1–4.

1854. *Supercytis digitata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1061, pl. 798, figs. 6–9.

The specific characters of this interesting form are brought out above in the generic description.

Occurrence.—Cretaceous (Coniacian): Fecamp, etc., France.

Genus UNICYTIS D'Orbigny, 1854.

1854. *Unicytis* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1047.

The ovicell is placed on the lateral face between two pinnules. The tubes are cylindrical, long, oriented without peristome, with dorsal gemmation, and ramified in the pinnules. All the pinnules are placed on the median axis of the frontal; they are composed of alternate bundles. The zoarium is surrounded on three sides by a thick calcareous epitheca formed of nematopores with very thick walls.

Genotype.—*Unicytis falcata* D'Orbigny, 1854. Coniacian-Campanian.

Structure.—In its general structure this genus is very close to *Truncatula* Hagenow, 1851, which is also provided with dorsal nematopores. It differs from it in its cylindrical and nonexpanded tubes and in its pinnules formed of two alternate bundles.

The apertures of the tubes are at the extremity of the pinnules. The triangular zoarium is surrounded by a dense layer of nematopores with thick walls, with orifices transverse and much smaller than the apertures.

UNICYTIS FALCATA D'Orbigny, 1854.

Plate 27, figs. 5–11.

1854. *Unicytis falcata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1048, pl. 794, figs. 8–12. (Geographic distribution.)

Structure.—In transverse section the tubes are nearly of the same size; they are therefore cylindrical; they are somewhat smaller toward the dorsal; their gemmation is therefore dorsal. The zoarium is almost surrounded by a very thick epitheca, in which the perforations of the nematopores are visible with difficulty.

The longitudinal section is quite original. Each pinnule is formed of two bundles, one coming from the right and the other from the left of the zoarial axis. The tubes are cylindrical; they are separated by a very large interzooecial canal.

The interpretation of the sections causes us to suppose that the reunion of the pinnules on the median axis of the zoarium arises from the reunion of two lateral and symmetrical pinnules of *Truncatula.* In reality the form *Unicytis* precedes the form *Truncatula* for it exists at the extremity of branches of specimens of this latter genus. It is more correct to say that *Truncatula* is derived from *Unicytis* by the separation of the two bundles forming each pinnule of the latter genus. We may add that the different forms of the tubes in these two genera imply some anatomical differences necessitating their separation.

Occurrence.—Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

Plesiotype.—Canu collection and Cat. No. 68993, U.S.N.M.

Genus SEMICYTIS D'Orbigny, 1854.

1854. *Semicytis* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1048.

The ovicell is placed on the cellular face, in the vicinity of the pinnules. The tubes are subcylindrical, oriented, little expanded, without peristome, with dorsal gemmation axial and irregular. No basal lamella. The apertures are placed on the anterior face of the trunk and of the pinnules. The mesopores are more or less numerous between the apertures. The zoarial dorsal is formed of a very large lamellar epitheca perforated by rectilinear vacuoles.

Genotype.—*Semicytis disparilis* D'Orbigny, 1854. Turonian-Santonian.

Structure.—As in the other genera of the same family, the gemmation is not exactly dorsal; it does not occur on the basal lamella. There are rather successive ramifications on a variable plane in the vicinity of the zoarial axis; the ramified tubes are sometimes polypidian and are then oriented towards the anterior face, sometimes aborted and oriented towards the posterior where they perforate a very thick epitheca of lamellar tissue.

This genus differs from *Truncatula* Hagenow, 1851, in the presence of mesopores. Its characteristics have been well recognized by D'Orbigny. Gregory reunites it with *Homoeosolen* but it differs, however, in the presence of adventitious tubes, vacuoles, and mesopores. It differs from *Desmepora* Lonsdale, 1850, in the presence of a lamellar tissue, which is dorsal and not peripheral, in the absence or great reduction of the zone of nematopores, in the presence of mesopores quite visible on the specimens and in tangential sections, and in the occurrence of the apertures on the trunk and on the pinnules.

SEMICYTIS DISPARILIS D'Orbigny. 1854.

Plate 26, figs. 1–4.

1909. *Homocosolen disparilis* Gregory, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 89, pl. 111, fig. 8 (Bibliography, Geological distribution).

Structure.—The apertures are distributed on the principal trunk of the zoarium and on the pinnules; between them are placed the mesopores irregularly arranged and generally smaller. The mesopores and the apertures have the same elongated form and are equally oblique.

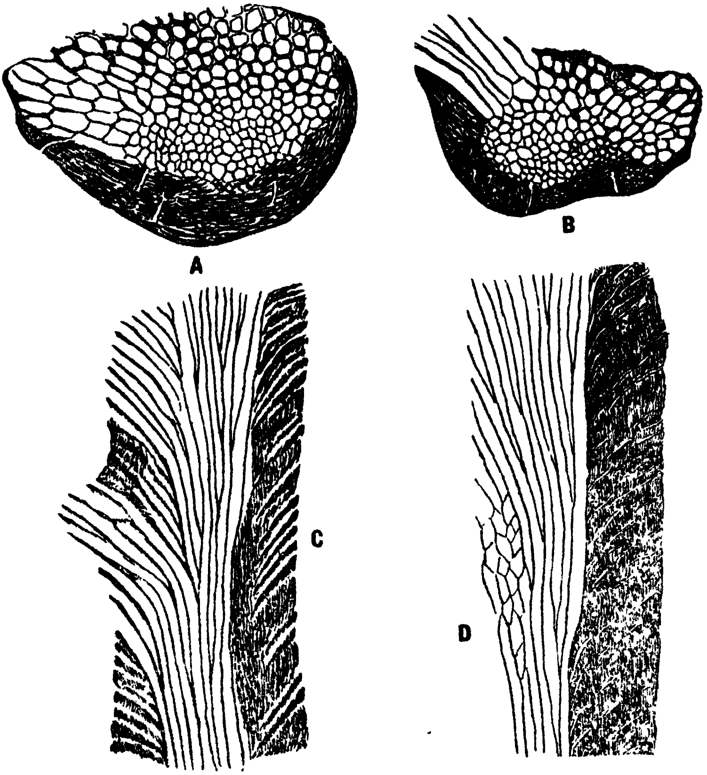


Fig. 16.—Semicytis disparilis D'Orbigny. 1854.

A. Transverse section, × 16, through a thick branch.

B. Transverse section, × 16, cutting a pinnule.

C. Longitudinal section, × 16, through an ordinary branch.

D. Portion of a longitudinal section, × 16, showing the thick dorsal perforated by the vacuoles and also possibly the central canal.

Cretaceous (Coniacian): Tours and Villedieu. France.

The longitudinal sections are quite variable; the two which we publish are not exactly similar to those of Pergens; they differ from them in the number of mesopores, the thickness of the lamellar epitheca, and in the form of the vacuoles often transformed into nematopores. The mesopores are more or less long and numerous, but their walls are always quite thick. The dorsal nematopores of Pergen's figure are transformed in our sections into veritable rectilinear or curved vacuoles perforating the epitheca. The gemmation is not exactly dorsal as it sometimes occurs by bifurcation at all heights but in a neighboring plane of the zoarial axis. The orientation of the tubes is the cause of this appearance. It is in reality a peripheral gemmation, oriented and symmetrical.

The transverse section shows the tubes a little smaller in the vicinity of the dorsal. These tubes are nematopores which become vacuoles. The vacuoles are quite small, much scattered.

The meridian section shows the habitual losenge-shaped areas observed on the basal lamella of species with dorsal gemmation. We can not explain the presence of the pointed partition at the middle of many of the losenge-shaped areas.

Occurrence.—Cretaceous (Coniacian): Villedieu and Lisle (Loir-et-Cher), Tours (Indre-et-Loire), and Les Phelippeaux (Charente), France.

Plesiotypes.—Canu collection and Cat. No. 68994, U.S.N.M.

SEMICYTIS FENESTRATA D'Orbigny, 1854.

Plate 26, figs. 5–7.

1909. *Homoeosolen fenestrata* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 93, pl. 2, figs. 9, 10; pl. 3, figs. 5, 6 (Bibliography, geological distribution).

Affinities.—D'Orbigny's figure representing the cellular face is not exact; we give a new photograph of a specimen coming from the same locality as D'Orbigny's type (Les Roches).

The difference from *Semicytis disparilis* is easy to see, namely, its much smaller zoarial dimensions and the very special form of the orifices of the vacuoles everywhere much more scattered and much less numerous.

Occurrence.—Cretaceous (Turonian): St. Calais and Connerré (Sarthe) and Luynes (Loir-et-Cher), France.

Cretaceous (Coniacian): Villedieu and Les Roches (Loir-et-Cher), France, and Chatham, England.

Plesiotypes.—Canu collection and Cat. No. 68995, U.S.N.M.

Genus DESMEPORA Lonsdale, 1850.

1850. *Desmepora* LONSDALE, Polyzoa, in Dixon's Geology and Fossils of the Tertiary and Cretaceous formations of Sussex, p. 281.

The ovicell is limited, little convex, surrounded by a deep, smooth groove, placed laterally between two pinnules. The tubes are long, cylindrical, oriented, with dorsal irregular gemmation, grouped in pinnules, without peristomes. The zoarium is surrounded by a thick, lamellar epitheca, perforated by vacuoles formed by the superior ramifications of the dorsal and frontal nematopores.

Genotype.—Desmepora semicylindrica Roemer, 1840.

Range.—Cenomanian-Danian.

The principal species of this genus are *Desmepora blackmorei* Gregory, 1909; *D. pinnigera* Gregory, 1909; *D. reussi* Gregory, 1909; and D. *rugosa* D'Orbigny, 1850.

This genus differs from *Osculipora* D'Orbigny, 1849, in its widened and noncylindrical tubes which are grouped in pinnules and not in fascicles.

The transverse section is very deceptive; it shows small pores toward the dorsal and large pores toward the frontal as in the Idmoneidae. This arrangement still does not indicate the presence of widened tubes for the longitudinal section indicates that they are cylindrical. In reality we can distinguish three zones—first, a thick peripheral zone formed of lamellar tissue; second, a posterior zone of small tubes or nematopores whose superior ramifications form the vacuoles; third, an anterior zone of large cylindrical tubes.

In accordance with this, the longitudinal section shows, first, an anterior zone of large cylindrical polypidian tubes, branched at all heights and diverging toward the pinnules; second, a posterior zone of nematopores, coming from the interior of the zoarium, directed in a contrary direction to the tubes and branching at their extremity into successive vacuoles; third, a peripheral zone of lamellar tissue, perforated by very irregular vacuoles. The vacuoles of the anterior part are also engendered by the nematopores coming from the interior of the zoarium and arranged between the tubes.

DESMEPORA SEMICYLINDRICA Roemer, 1840.

Plate 28, figs. 1–7.

1840. *Idmonea semicylindrica* ROEMER, Die Versteinerungen des norddeutschen Kreidegebirges, p. 20, pl. 5, fig. 21.

1909. *Desmepora semicylindrica* GREGORY, Catalogue Fossil Bryozoa in British Museum Cretaceous, p. 110, fig. 29.

Structure.—The lamellar epitheca is very thick especially on the dorsal, as indicated by the transverse section. The tubes are much smaller towards the center, or in the vicinity of the dorsal, which indicates their widened nature (club shaped).

The longitudinal sections are very difficult to make because of the great thickness of the lamellar epitheca. The tubes are cylindrical and are very long. There is no basal lamella, and although the gemmation appears dorsal, because of the orientation of the tubes, it is very irregular and occurs at all heights. A section reveals the presence of vacuoles, perfectly characterized by their curvature. A second bears only nematopores with very thick walls; finally, a third bears vacuoles below and nematopores above. These are variations in accordance with the general structure previously described.

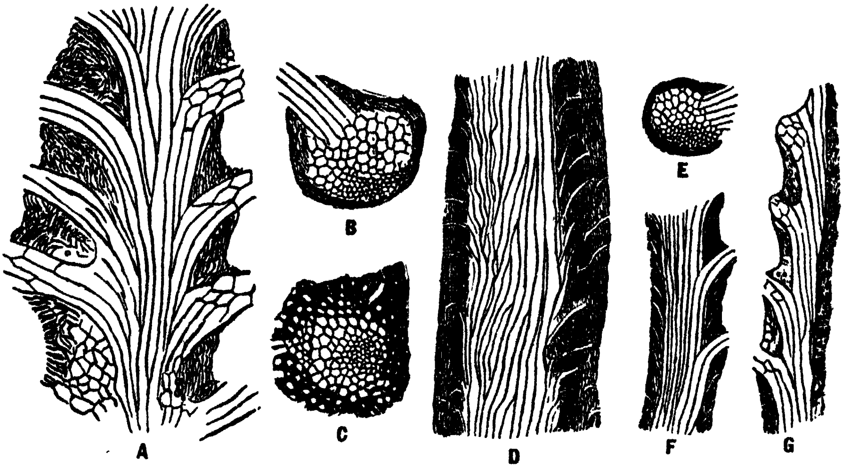


FIG. 17.—A–D. Desmepora semicylindrica Roemer, 1840.

A. Meridian section, × 12, in a specimen with outspread pinnules.

B. Transverse section, × 12, through a pinnule and showing the cylindrical tubes of the pinnule, the peripheral zone of lamellar tissue, the anterior zone of polypidian tubes and the posterior zone of nematopores.

C. Transverse section, × 12, not cutting a pinnule.

D. Longitudinal section, × 12, through a branch with a very thick epitheca.

Cretaceous (Danian): Moen, Denmark.

E–G. Desmepora rugosa D'Orbigny, 1854.

E. Transverse section, × 12, through a pinnule and showing the three zones of tubes as in Figure B.

F. Longitudinal section, × 12, illustrating the zone of nematopores to the left and that of polypidian tubes to the right. The vacuoles arise from the nematopores.

G. Longitudinal section, × 12, passing through the pinnules.

Cretaceous (Campanian): Bonneville, France.

The true arrangement of the tubes may only be known on the meridian sections of the specimens with pinnules exactly parallel to the frontal plane; we have not had the opportunity to discover such a specimen and to verify the figure given by Gregory. The latter appears to be rather a tangential section. The orifices of the tubes are oblique, irregular, grouped at the extremity of the pinnules. The exterior decoration of the zoarium is very curious. The adventitious pores are arranged in longitudinal rows and open transversally. In the sections this very irregular arrangement does not exist and the adventitious tubes, vacuoles or nematopores are here of a disconcerting irregularity.

The orientation of the tubes on a single face of the zoarium does not appear in itself a good generic character. It is remarkable, however, that in most cases all the species of the same genus have the tubes equally oriented.

Occurrence.—Cretaceous (Turonian): Fontaine d'Antoigné, near Chatellerault (Vienne), Connerré, St. Calais, and Dunneau (Sarthe), and Luynes (Indre-et-Loire), France. Danian of Denmark.

Cretaceous (Coniacian): Tours (Indre-et-Loire), France.

Plesiotypes.—Canu collection and Cat. No. 68996, U.S.N.M.

DESMEPORA RUGOSA D'Orbigny, 1850.

1850. *Osculipora rugosa* D'ORBIGNY, Prodrome de paléontologie stratigraphique, vol. 2, p. 268.

1909. *Semicytis rugosa* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 119, pl. 3, figs. 3, 4 (Bibliography, geologic distribution).

Historical.—Gregory was the first to perceive that this species was not similar to the other *Semicytis* described by D'Orbigny; he recognized its exact structure in introducing it in the Desmeporidae. Unfortunately believing that the other *Semicytis* were *Homoeosolen*, he believed it necessary to preserve the generic name of D'Orbigny for this single species. However, he declared (p. 119) that the two genera *Semicytis* and *Desmepora* are synonymous. In reality *Semicytis rugosa* is indeed a *Desmepora*, and we have indicated previously the true nature of the *Semicytis* of D'Orbigny.

Structure.—In longitudinal section the tubes are long, little widened, subcylindrical, with irregular dorsal gemmation. The zoarial walls are thick and perforated by short vacuoles. The frontal nematopores are quite distinct.

The zoarium is small and much attenuated, so that the preparation of the section is very difficult. The base is a small flat disk.

Occurrence.—Cretaceous (Coniacian): Fécamp (Seine inferieure) and Tours (Indre-et-Loire), France, and Chatham, England.

Pleisiotypes.—Canu collection and Cat. No. 68997, U.S.N.M.

Subdivision RECTANGULATA Waters, 1887.

In this convenient and well-marked subdivision of the Cyclostomata the ovicell is developed between the peristomes perpendicularly to the axis of the terminal zooecia and not between the tubes and parallel with this axis as in the subdivision Parallelata. The Rectangulata include most of the so-called "heteroporoids" and "cerioporoids," although in the type species of both *Heteropora* and *Ceriopora* the ovicell has not yet been discovered, and the position remains doubtful.

Family LICHENOPORIDAE Smitt, 1866.

Figures and descriptions of this family and its genera are given in Bulletin 106, United States National Museum. The following species of *Lichenopora* is introduced on account of its peculiarities:

Genus LICHENOPORA Defrance, 1823.

LICHENOPORA BURDIGALENSIS Duvergier, 1921.

Plate 12, figs. 1–3.

1821. *Lichenopora burdigalensis* DUVERGIER, Note sur les bryozoaires du Néogène de l'Aquitaine, Actes Société Linnéenne de Bordeaux, vol. 72, p. 41, pl. 4, figs. 11–13.

The type and only specimen is incomplete. The tubes appear narrow, arranged in radial, uniserial rows, but not in fascicles. The cancelli are large and polygonal and occupy almost all of the zoarium observed. The ovicell is large, flat, surrounded by numerous ramifications situated between the rows of tubes; its surface is very finely porous; the marginal thread is thick and salient. On the inferior face the tubes are arranged eccentrically in a manner to form a flabelliform ensemble as in *Berenicea.*

Among the recent species, *Lichenopora californica* Busk, 1875, and *L. holdsworthii* Busk, 1875, have an analogous ovicell. The discovery of this fossil species is therefore quite important, and the entire group will probably be separated generically when the oeciostome is better known. In the other species of *Lichenopora* the ovicell is a central expansion not marginated and not digitate.

Occurrence.—Miocene (Upper Burdigalian): Saucats (Pontpourquey) Gironde, France.

LOBOSOECIIDAE, new family.

The ovicell is a convex lobed vesicle formed after the consolidation of the subjacent tubes. The oeciostome is central, large, transverse, salient; the oeciopore is larger than the aperture.

This family differs from the Eleidae, in which the tubes are also provided with a zooecial area, in its central and not terminal oeciostone and in its ovicell, which is lobed and not regularly elliptical. It differs from the Diaperoeciidae in which the oeciostome is also central, in the presence of lateral lobes to the ovicell and the closing of the subjacent tubes. But a single genus is known, namely, *Lobosoecia.*

LOBOSOECIA, new genus.

Greek: *lobos*, lobe; in allusion to the form of the ovicell.

The ovicell is lobed. The tubes are without peristome, widened, oriented, long, with dorsal gemmation; the walls are very thick at the extremity; the zooecial area is hexagonal; the aperture is round.

Genotype.—Lobosoecia semiclausa Michelin, 1846. Cretaceous.

LOBOSOECIA SEMICLAUSA Michelin, 1846.

Plate 12, figs. 4–11.

1846. *Meliceritites semiclausa* MICHELIN, Iconographie zoophytologique, p. 211, pl. 53, fig. 3.

1899. *Meliceritites semiclausa* GREGORY, Catalogue fossil bryozoa in the British Museum, Cretaceous, p. 328, pl. 14, figs. 1, 2, 3 (not fig. 29) (not synonymy).

Structure.—The aperture is orbicular. This is the principal character of this species which has been well figured by Michelin and by Gregory, although the bibliography of the latter author is incorrect. D'Orbigny appears to be the initial author of the confusion.

The zooecial area is rhomboidal or hexagonal with a tuberosity at the angles. The transverse section shows the tubes increasing in size towards the periphery and an external, very thick zoarial wall. The longitudinal section exhibits the habitual tubes observed in species having a zooecial area. They are regularly widened, with dorsal gemmation, and the walls are very thick at their extremity.

The ovicell surmounts a number of zooecia, the apertures of which are thus closed. The lobes extend between the peripheral apertures. The oeciostome is thick, funnel shaped, transverse, with a sort of proximal lip. The oeciopore is twice as large as the apertures and its form is that of a crescent.

Occurrence.—Cretaceous (Cenomanian): Le Mans (Sarthe), France, and Warminster, England (Gregory).

Family ELEIDAE D'Orbigny, 1852.

Bibliography (morphological).—1852. D'ORBIGNY, Paléontologie française, Terrain Crétacé, p. 1585.—1899. GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 285.—1912. LEVINSEN, Studies on the Cyclostomata operculata, Memoires de l'Academie Royal des Sciences et des Lettres de Danemark, vol. 10, p. 19.

The ovicell is a large, pyriform, globular sack, with well-defined outlines. It is formed on the completely consolidated distal tubes.

The oeciostome is terminal. The tubes are closed by a perforated facette.

The genera of this family here discussed are *Meliceritites* Roemer, 1840, and *Cyclocites*, new genus. Numerous names applied to various forms of growth have been given, but the structure of the genotype of each must be restudied before they can be recognized.

Genus MELICERITITES Roemer, 1840.

1840. *Meliceritites* ROEMER, Die Versteinerungen des norddeutschen Kreidegebirges, p. 18.

The tubes are expanded at their recurved extremity. Their gemmation is dorsal around one or more cylindrical axial tubes with regular peripheral gemmation. The orifice of the facettes is semicircular.

Genotype.—*Meliceritites* (*Ceriopora*) *gracilis* Goldfuss, 1827.

The genera created by D'Orbigny and now considered synonyms of *Meliceritites*, are based upon zoarial differences only, but nevertheless it is still necessary to verify all of them by properly made thin sections. Most of the species of this genus exhibit special zooecia termed eleocellaria whose forms are very useful in specific determinations.

Very frequently the tubes are arranged in transverse rows. The longitudinal sections then have a special aspect as the hollow tubes appear to alternate with solid ones; in reality the latter are formed by the walls of the tubes placed regularly between two others.

There are several sorts of tubes shown in the same section. At the center the tubes are capillary, cylindrical, and may not have borne polypides. They ramify more regularly than in *Heteropora* and related genera. Laterally the polypidian tubes are greatly expanded and considerably broader but much less in length; they result from the last ramifications of the small central tubes. This arrangement of the tubes is not restricted to the Eleidae as it may be observed in the Plagioeciidae (*Filicea*, *Laterocea*) and in the Ceriocavidae. The section through an eleocellarium is identical with that through the other tubes. The eleocellaria appear therefore to form merely external ornaments.

The calcareous lamella which closes the tubes is not a mobile operculum, as often thought, but it is identical with the lamella, which closes the tubes of a large number of cyclostomatous bryozoa when the polypide dies or becomes aborted.

The discovery of the ovicell of the Eleidae was made by Canu in 1897,[6] when he figured this structure on two occasions.[7] Levinson attributed this discovery to Gregory, but the catalogue of the British Museum in which his results appeared was not published until 1899.

---

[6] Bryozoaires du Turonien des Janieres, Bulletin Société Geologique France, ser. 3, vol. 25, p. 150, pl. 5, fig. 10.

[7] Idem, pp. 750, 752, 753, pl. 22, figs. 1, 2, 3, 6.

MELICERITITES GRACILIS Goldfuss, 1827.

Plate 13, figs. 1–4.

1827. *Ceriopora gracilis* GOLDFUSS, Petrefacta Germaniae, vol. 1, p. 35, pl. 10, fig. 11*a–c*.

1899. *Melicerititites gracilis* GREGORY, Catalogue of Cretaceous Bryozoa in the British Museum, vol. 1, p. 324, fig. 38 (not synonymy).

1912. *Melicerititites gracilis* LEVINSEN, Studies on the Cyclostomata operculata, Kgl. Danske Vidensk Selsk. Skrifter, ser. 7, vol. 10, p. 28, figs. *a*, *b*.

Not Michelin, 1845, Roemer, 1840, Reuss, 1872, Marsson, 1887, Pergens, 1890, Canu, 1897, Hagenow, 1851, etc.

Measurements.—	Apertura	$ha=0.10$ mm. $la=0.18$ mm.
	Peristome	$hp=0.28–0.32$ mm. $lp=0.24–0.28$ mm.
	Operculum	$ho=0.18$ mm. $lo=0.18$ mm.
	Ovicell	$Lo=0.90$ mm. $lo=0.90$ mm.
	Oeciostome	$hoe=0.10$ mm. $loe=0.22$ mm.
	Oeciopore	$hp=0.08$ mm. $lp=0.16$ mm.
	Facettes	$hf=0.40–0.44$ mm. $lf=0.26–0.28$ mm.

Structure.—The specimen figured by Goldfuss in 1827 was incomplete and worn and his poor illustration has occasioned many false determinations. With better specimens derived from the same locality (Essen, Germany), Gregory, in 1899, and Levinsen, in 1912, have described the various characters of this species and given better figures. We are able finally to complete their observations.

The tubes are arranged in transverse rows. The peristomes are thin, salient, elongated, triangular, adjacent at their base. The aperture is little transverse, semicircular, concave at its proximal margin; it is placed at the bottom of a peristomie and its form does not correspond to that of the peristome. The operculum is triangular and covers the aperture and the calcified portion of the distal peristome. The facettes are lozenge shaped, finely punctate, and half of their surface is occupied by the peristome; they are somewhat convex and separated by little salient threads.

In order to interpret the oral arrangement it is necessary to admit that the expanded and recurved part of the tubes is elliptical in section and that with the operculum inserted in a circle, the diameter of the latter ought to correspond to that of the tentacular sheath.

The ovicell belongs to a short type already noted in *Meliceritites transversa* new species and *Meliceritites semiclausa*, variety Gregory, 1899. It is triangular, very convex, as broad as long. The oeciostome is supported on the facette of the superior zooecium; it is elliptical and transverse (fig. 3).

The micrometric measurements of the facettes are rather changeable, especially in width (figs. 3, 4). The aperture itself can vary from 0.15 to 0.18 mm. The width of the facettes, 0.34 mm., given by Gregory is an extreme case and rather rare. The zoarial diameter is also variable, for the colonies appear to be very large; our specimens are 2 mm. in diameter, but the measurement of 2 to 5 mm. given by Gregory is quite possible.

Levinsen, 1912, has noted closed zooecia (kenozooecia), while Gregory, 1899, and Levinsen, 1912, have indicated the perforated facettes. We have not observed this particular case but they are quite natural.

Occurrence.—Cretaceous (Cenomanian): Essen, Germany. The species has been found with certainty in no other locality. It is regrettable that Gregory chose it as the genotype of Roemer's genus *Meliceritites*, 1840, because Roemer misidentified the species himself (see *Entalophora roemeri* Levinsen, 1912). The synonymy of the species contains only the references given above.

Plesiotype.—Cat. No. 68935, U.S.N.M.

MELICERITITES ANGULOSA D'Orbigny, 1852

Plate 12, figs. 17–22.

1912. *Meliceritites angulosa* LEVINSEN, Studies on the Cyclostomata Operculata, Memoires Academie Royale Sciences et Lettres de Danemark, ser. 7, vol. 10, p. 23, pl. 2, figs. 4–22 (bibliography).

This species, which is very common in France, has been figured under many names by D'Orbigny. Canu retained the name of *ornata* in 1899, but Levinsen preferred the one which was printed first by D'Orbigny (p. 610, Paleontologie française).

On plate 12 we figure a curious ovicelled specimen in which the oeciostome is transformed into an eleocellarium.

Occurrence.—Cretaceous (Coniacian): Fecamp (Seine inferieure), Villedieu (Loir-et-Cher), Tours, Saint Paterne (Indre-et-Loir), and Phelippeaux (Charente), France; Chatham, England.

Cretaceous (Santonian): Coulommiers near Vendome (Loir-et-Cher), Barbezieu, Bedocheau and Champagnac (Charente), France.

Cretaceous (Campanian): St. Medard, Brossac, and Piaud (Charente), France.

Plesiotype.—Cat. No. 68936, U.S.N.M.

MELICERITITES LAMELLOSA D'Orbigny, 1852.

Plate 14, fig. 13.

1852. *Elea lamellosa* D'ORBIGNY, Paléontologie française, Terrain Crétacés, vol. 5, p. 632, pl. 625, figs. 11–15.

1912. *Melicerilites lamellosa* LEVINSEN, Studies on the Cyclostomata Operculata, Mémoires Académie Royale Sciences et Lettres de Danemark, ser. 7, vol. 10, p. 45, pl. 3, figs. 1–9 (bibliography).

This species is quite common in France where it is best known under the name given by D'Orbigny, *Elea lamellosa*, its zoaria consisting of expanded twisted fronds. We figure a splendid ovicell giving a good idea of the regularity of these beautiful fossils. The oeciopore is transverse and elliptical.

Occurrence.—Cretaceous (Coniacian): Fecamp (Seine inferieure), Phelippeaux (Charente), Tours, Saint Paterne (Indre-et-Loir), Villedieu and Lisle (Loir-et-Cher), France.

Cretaceous (Santonian): Coulommiers near Vendome and Romorantin (Loir-et-Cher), France.

Plesiotypes.—Cat. No. 68937, U.S.N.M.

MELICERITITES MAGNIFICA D'Orbigny, 1852.

Plate 12, figs. 12–16.

1852. *Multelea magnifica* D'ORBIGNY Paleóntologie française, Terrain Cretacé, vol. 5, p. 649.

1912. *Melicerititcs magnifica* LEVINSEN, Studies on the Cyclostomata Operculata, p. 20, pl 1, figs. 3–10; pl. 7, figs. 13–19 (not synonymy).

Under this name D'Orbigny has confounded three species, as is well shown by his collection in the Museum of Natural History at Paris. Nevertheless the name can be maintained for the figured specimens which were obtained from the Coniacian of the Loire Valley. The second species is *Meliceritites arbusculus* Leymerie, 1841, a species badly figured, which Waters named *Melicerititcs royana* in 1891.

The ovicell is irregular in its general form; to the two variations noted by Levinsen in 1912 we here add a third (fig. 14). Our sections confirm those of Hennig, of Gregory, 1899, and of Levinsen, 1912. We have still not been able to discover the origin of the successive lamellae which form the large zoaria.

Very common in the valley of the Loire, this species is rarer in the Charentes. It characterizes the lower Senonian.

Occurrence.—Cretaceous (Coniacian): Tours, (Indre-et-Loire), Phelippeaux (Charente), and Villedieu (Loir-et-Cher), France.

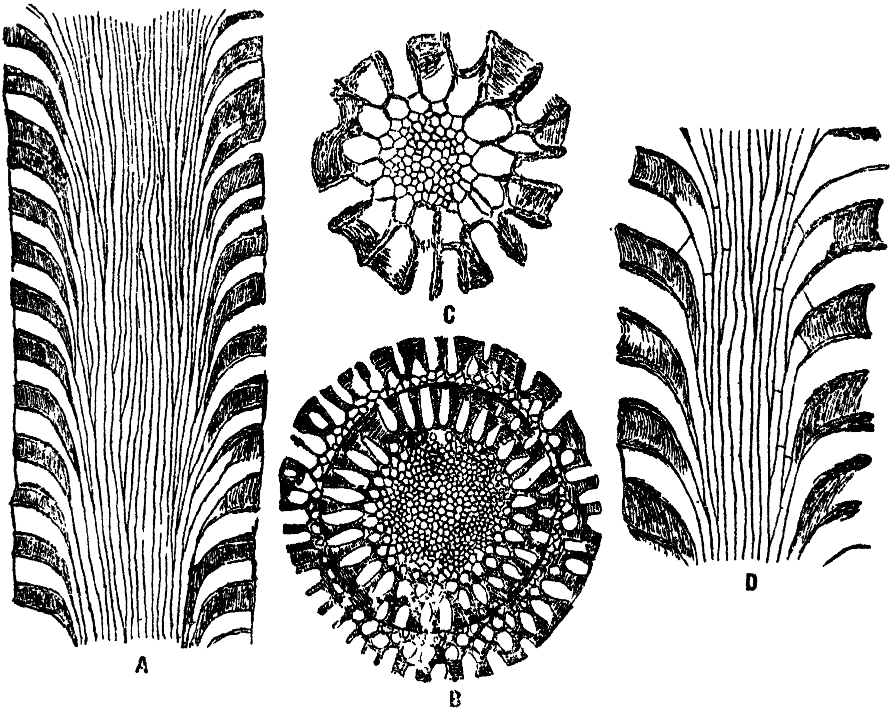


Fig. 18.—Genus Meliceritites Roemer, 1840.

A, B. *Meliceritites magnifica* D'Orbigny, 1852. A. Longitudinal section, × 16, illustrating the narrow central tubes and the expanded lateral ones with the facettes preserved in many cases. B. Transverse section, × 16, through a branch with a superimposed layer of zooecia.

Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

C, D. *Meliceritites* (*Foricula*) *aspera* D'Orbigny, 1852. C. Transverse section, × 16. D. Longitudinal section, × 16, with a few diaphragms in the tubes.

Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

Cretaceous (Santonian): Coulommier Canal, near Vendome (Loir-et-Cher), Bedocheau and Barbezien (Charente), France.

Plesiotypes.—Cat No. 68938, U.S.N.M.

MELICERITITES ASPERA D'Orbigny, 1852.

Plate 14, figs. 10–12.

1852. *Foricula aspera* D'Orbigny, Paléontologie francaise, Terrain Crétacé, p. 659, pl. 742, figs. 1–5.

1912. *Melicertites pyrenaica* Levinsen, Studies on the Cylostomata Operculata, Mémoires Académie Royale Sciences et Lettres de Danemark, p. 36, pl. 6, figs. 11–21; pl. 7, fig. 30.

The species described as *Meliceritites pyrenaica* by Levinsen is certainly the same as *M. aspera*. The material was furnished him by Canu and error in the labeling was probable.

The species of D'Orbigny's group *Foricula* are very easy to recognize exteriorly by the punctations arranged irregularly between the apertures. These small pores are little apparent in tangential sections and they are not visible in longitudinal sections. They are apparently produced simply by irregularities of calcification as Levinsen has already mentioned.

The group *Foricula* appears to be characterized by the presence of diaphragms in the tubes, visible in the longitudinal section but we do not believe that these diaphragms are of generic order.

Occurrence.—Cretaceous (Coniacian): Villedieu (Loir-et-Cher), Tours and Saint Paterne (Indre-et-Loire), and Phelippeaux (Charente), France.

Cretaceous (Campanian): Brossac, Piaud and Roux (Charente), France.

MELICERITITES (FORICULA) SPINOSA D'Orbigny, 1852.

1852. *Foricula spinosa* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 659, pl. 742, figs. 6–8.

This species is very common in the Charentes and we believed it worth while to give its geological distribution.

Occurrence.—Cretaceous (Campanian): Deviat, St. Bonner, St. Médard, Chez Béron, Saint Aulais, Courgeac, Echebrune-Meussac, and Montmoreau, France.

Maastrichtian (Dordonian): Chillac, Roux, Fouchalon, Manie-Roux, Bessac, Sainte-Leur, Chez-Beron, D'Archiac, and Manie-Mulon, France.

Genus SEMIMULTELEA D'Orbigny, 1852.

SEMIMULTELEA ESCHAROIDES Goldfuss, 1827.

Plate 13, figs. 5–7.

1827. *Cellepora escharoides* GOLDFUSS, Petrefacta Germaniae, vol. 1, p. 28. pl. 12, fig. 3*a–c*.

Measurements.—	Apertures	ha=0.12 mm. la=0.14 mm.
	Facettes	hf=0.50 mm. lf=0.22 mm.
	Eleocellaria	L=0.64 mm. l=0.28 mm.

Although this species is found frequently in the collections of the principal museums of Europe, it is always represented by very poorly preserved specimens. Most often these are large, free, multilamellar, more or less expanded masses, for which the name *Semimultelea* was proposed by D'Orbigny in his zoarial classification.

Our specimens show the same general characters, but they are globular or subcylindrical and some portions of the surface are a little better preserved, permitting us to observe the principal external characters.

The apertures are ogival and surrounded by a thin, little salient peristome. The facettes are smooth, convex, sometimes separated by a salient thread.

The eleocellaria are quite large, more or less broadly spatulate at their distal extremity. They are not rare, although Goldfuss does not mention them.

The zoarial lamellae seem to be formed of suborbicular colonies coalescing irregularly.

Occurrence.—Cretaceous (Cenomanian): Essen, Germany.

Plesiotypes.—Cat. No. 68939, U.S.N.M.

CYCLOCITES, new genus.

The tubes are expanded at their recurved extremity. Their gemmation is dorsal around a bundle of cylindrical tubes with regular peripheral gemmation. The orifice of the facette is circular.

Genotype.—*Cyclocites primogenitum*, new species. Bathonian.

This genus differs from *Meliceritites* Roemer, 1840 in the circular form of the aperture. There is no eleocellarium nor is there an oeciostome.

CYCLOCITES PRIMOGENITUM, new species.

Plate 15, figs. 9–12.

Description.—The zoarium is formed of anastomosing, ramifying, cylindrical branches very diverging in their relation to each other. The facettes are little distinct, flat, separated by a furrow of little depth. The aperture is orbicular, placed anteriorily on the facette. The peristome is thin and very little salient. The tubes of the central bundle are long, cylindrical, rectilinear, with regular peripheral gemmation. The lateral tubes are horn shaped, much expanded and recurved almost at right angles at their extremity. The ovicell is large, pyriform, convex; the oeciopore is orbicular.

Measurements.—	Diameter of branches	2.5 mm.
	Diameter of the facettes	.25–0.30 mm.
	Diameter of apertura	.13– .15 mm.

Variations.—The facettes which are very fragile, disappear very easily, and the tubes are then terminated by a large irregular orifice, the walls of which as seen in tangential section are vacuolar. In longitudinal section the tubular walls appear also vacuolar but very irregularly so. The tubular walls of the central bundle are plain.

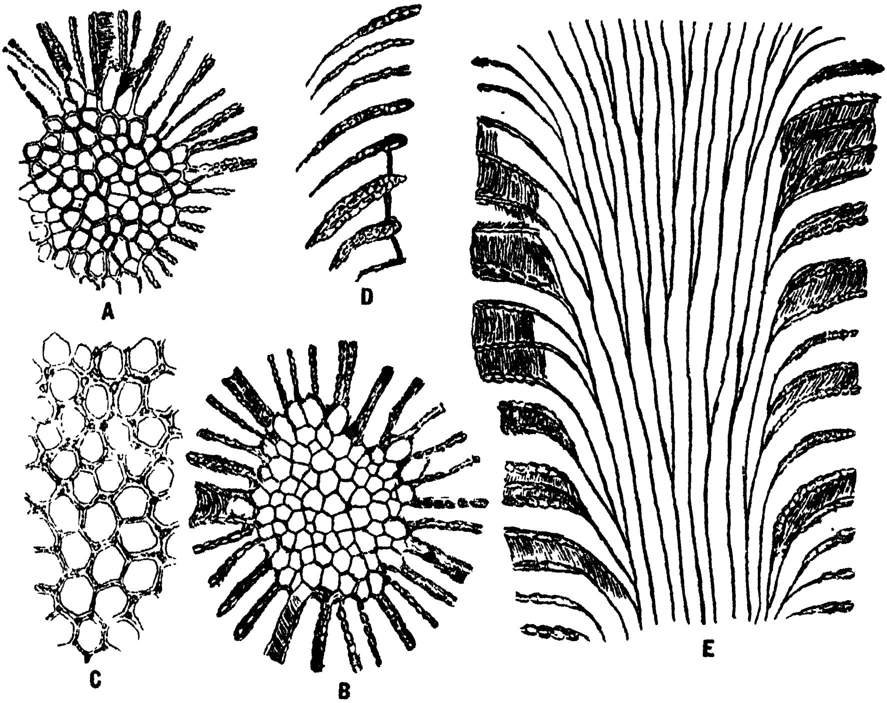


FIG. 19.—Cyclocites primogenitum, new species.

A. Portion of transverse section, × 16, showing structure of central tubes.
B. Transverse section, × 16.
C. Tangential section, × 16, illustrating the vesicular structure of the walls.
D. Portion of a longitudinal section, × 16, with the facettes still preserved.
E. Longitudinal section, × 16, exhibiting the central bundle of cylindrical tubes and the thickened lateral tubes with vesicular walls.
Jurassic (Bathonian): Ranville (Calvados), France.

Occurrence.—Jurassic (Bathonian): Ranville (Calvados), France.
Cotypes.—Canu collection and Cat. No. 68940, U.S.N.M.

CERIOCAVIDAE, new family.

The ovicell is a long, transverse, convex, regular, symmetrical vesicle with special walls. The oeciostome is large, median, tubular, salient.

The ovicell closes a certain number of tubes which are necessarily aborted; it is necessary, therefore, to classify this family in the section of the Rectangulata. This family differs from the Plagioeciidae, particularly in the position of the ovicell which is placed above the peristomes and not below them.

Ceriocava D'Orbigny, 1852; *Spiroclausa* D'Orbigny, 1852; *Haplooecia* Gregory, 1896; and the new genera *Grammecava* and *Ripisoecia* are referred to the family.

Genus CERIOCAVA D'Orbigny, 1852.

1852. *Ceriocava* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1015.

The gemmation is peripheral. The tubes are long, cylindrical in their ascending portion, and rectilinear and much widened in their terminal recurved portion. There is no peristome. There are diaphragms in the cylindrical portion and the walls are vesicular in the outer widened portion of the tubes.

Genotype.—*Ceriocava* (*Millepora*) *corymbosa* Lamouroux, 1821.

Structure and affinities.—The form of the tubes in this genus is quite unique; it has not yet been observed in other genera and it has long been extinct. Gregory, 1896, maintained that this genus is of the same type as *Entalophora*. This is an error, as it differs in the gemmation, which is peripheral (and not dorsal), in the cylindrical tubes, in their greater length (and not regularly widened), and in the presence of diaphragms.

CERIOCAVA CORYMBOSA Lamouroux, 1821.

Plate 14, figs. 1-8.

1821. *Millepora corymbosa* LAMOUROUX, Exposition méthodique des genres de l'ordre des Polypiers, p. 87, pl. 83, figs. 8, 9.

1896. *Ceriocava corymbosa* GREGORY, Catalogue fossil bryozoa in the British Museum. Jurassic, p. 163, fig. 13 (Bibliography).

Structure.—Our studies have been made on the form *Ceriopora pustulosa* Michelin, 1846, which is rather common in France.

The ovicell is rather rare; it is not always completely developed, but it occurs in the form of elongate vesicles. It has its own special wall, which is never common with those of the zooecia; this is the rule in Rectangulata, but we are totally ignorant as to how this calcification occurs.

The transverse section embraces two parts. In the center the tubes are of the same diameter and correspond to the cylindrical tubes. The periphery corresponds to a longitudinal section in the recurved portion of the tubes; this portion is widened and the walls are vesicular and striated in the interior.

The longitudinal section shows the tubes divided in two portions. They are cylindrical in their greater length, ascending and rectilinear; the walls are thin and adjacent and there are diaphragms far apart; the gemmation is peripheral, since the tubes are bifurcated at all heights. The terminal portion is recurved almost at right angles to the zoarial axis; it enlarges much and very rapidly; the

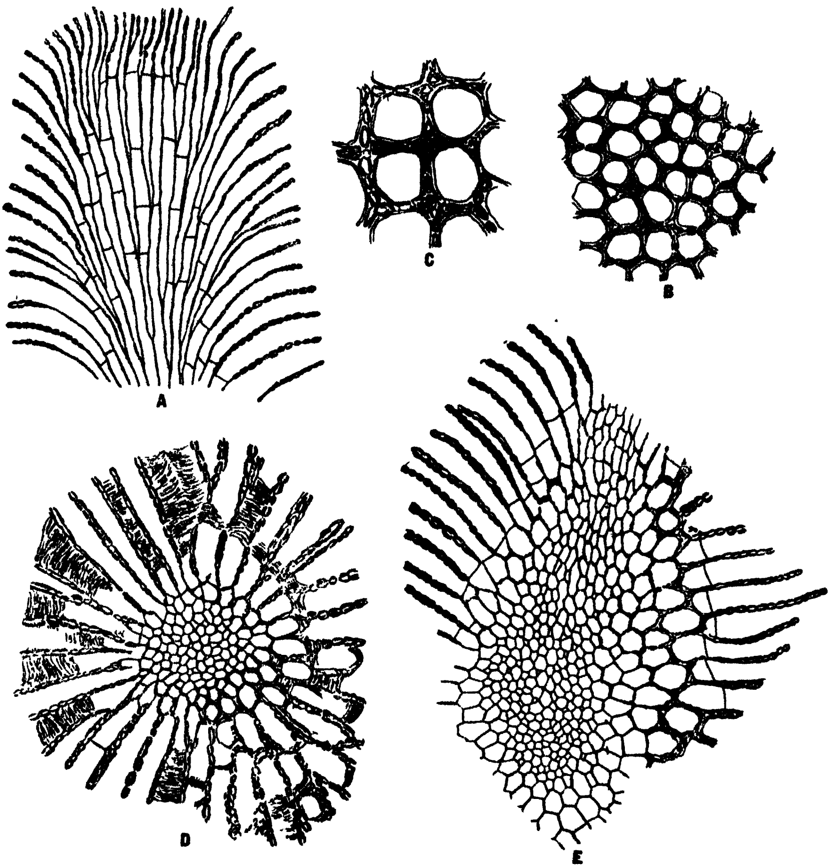


FIG. 20.—*Ceriocava corymbosa* Lamouroux, 1821.

A. Longitudinal section, × 12, illustrating the thin tubes with diaphragms in the central region and the thickened, vesicular walls of the outer portion.

B, C. Tangential section, × 12 and a portion, × 25, showing the structure.

D. Transverse section, × 12.

E. Longitudinal section, × 12, through a branch showing a perpendicular bifurcation.

Jurassic (Bathonian): St. Aubin (Calvados), France.

vesicles of the walls increase in size toward the periphery and leave between them small pores of communication.

In tangential section the apertures are irregularly polygonal; they are surrounded by a sort of annular canal formed by the section cutting the parietal vesicles.

Occurrence.—Jurassic (Bathonian): St. Aubin, Ranville, and Langrune (Calvados), France.

Plesiotypes.—Canu collection and Cat. No. 68941, U.S.N.M.

Genus SPIROCLAUSA D'Orbigny, 1852.

1852. *Spiroclausa* D'ORBIGNY, Paléontologie française, Terrain Crétacé, p. 883.

In the Paléontologie Francaise D'Orbigny has exactly limited all of his genera, but they are not entirely concordant with the descriptions in the Prodrome, because these later studies were more complete, the material more numerous, and the publication was more definite. We can not admit the changes made by Gregory in the classification, and we preserve the genus *Spiroclausa* as it is defined in the Paléontologie Francaise. Gregory, 1899, has classified the genus *Spiroclausa* in the same family as *Terebellaria*, but this is impossible, for the ovicells are quite different.

The genotype is extremely curious on account of its spiral zoarium in appearance, like that of a corkscrew. The ovicell is a smooth sack, little salient, elongated, and located between the salient spirals. It appears to us to have some analogy with that of the *Leiosoeciidae*, although we believe the genus better placed in the *Ceriocavidae* at present.

The tubes are cylindrical with hollow walls.

SPIROCLAUSA SPIRALIS Goldfuss, 1827.

Plate 14, fig. 9.

1827. *Ceriopora spiralis* GOLDFUSS, Petrefacta Germaniae, Bryozoa, vol. 1, p. 36, pl. 11, fig. 2.

1852. *Spiroclausa spiralis* D'ORBIGNY, Paléontologie francaise, Terrain Crétacé, vol. 5, p. 883, pl. 764, figs. 1–5.

1899. *Zonopora spiralis* GREGORY, Catalogue fossil bryozoa in British Museum. Cretaceous, vol. 1, p. 427 (Bibliography).

Structure.—The ovicell is a convex sack, smooth, located between two successive spires. The tubes of the salient spires are long in longitudinal section. Between them and forming the concave spirals the shorter dactylethrae are arranged; they grow by successive ramifications most of the time. Sometimes, however, they are transformed into mesopores—that is to say, into anterior and superior ramifications of a single tube.

It is probable that this unusual spiral mode of growth is the cause of the modification in form of the ovicell.

When worn the specimens offer slightly the aspect of *Zonopora*, but the spires always remain regular.

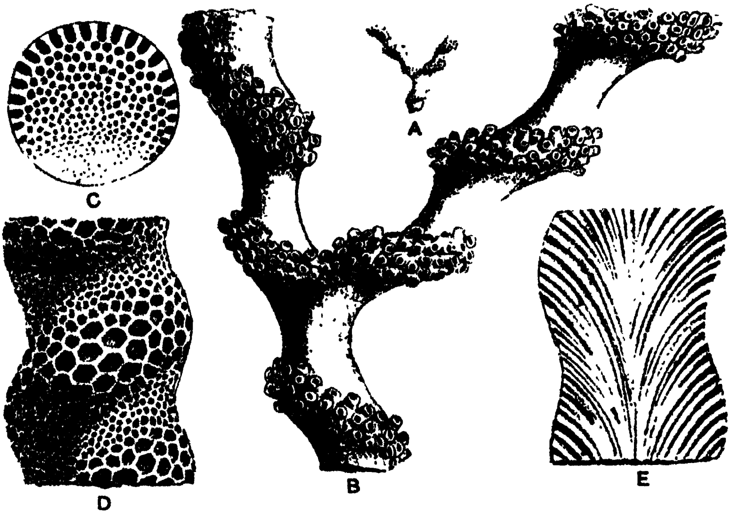


FIG. 21.—Spiroclausa spiralis Goldfuss, 1827.

A, B. Zoarium natural size and enlarged.
C. Transverse section enlarged.
D. Portion of a branch, enlarged.
E. Longitudinal section, enlarged. (A–E, after D'Orbigny.)
Cretaceous of France.

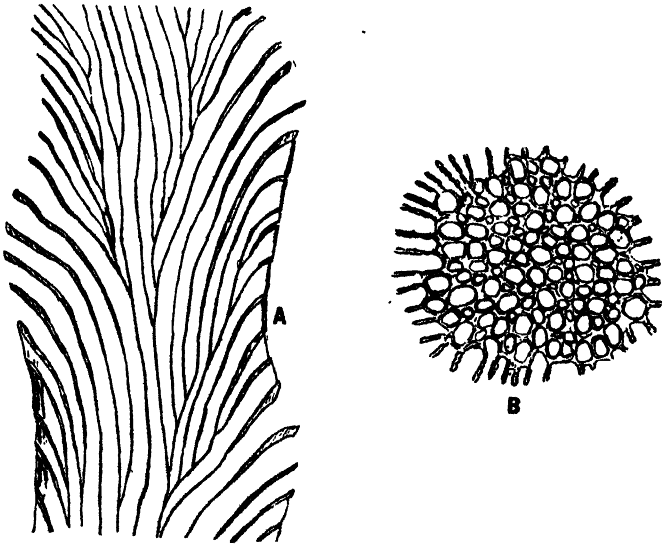


FIG. 22.—Spiroclausa spiralis Goldfuss, 1827.

A. Vertical section, × 16 .
B. Transverse section, × 16.
Cretaceous (Maastrichtian) : Royan (Charente inferieure), France.

Occurrence.—Cretaceous (Campanian): Longuesse (Seine-et-Oise), Montmoreau and Courgeac (Charente), France.

Cretaceous (Maastrichtian): Poulipiac (Le Gabriel), Mouchaud, Bessac, Barbezieux and Manie Roux (Charente) and of Royan (Charente inferieure), France and Maastricht, Holland.

RIPISOECIA, new genus.

(Greek. *Ripis*, fan, alluding to the form of the ovicell.)

The ovicell is a flabelliform vesicle, little convex, striated transversally. The tubes are cylindrical, long, with peristomes, recurved in their distal part; their walls are hollow in the axial portion and vesicular in the terminal portion. The mesopores are closed by a calcareous lamella.

Genotype.—*Ripisoecia* (*Millepora*) *conifera* Lamouroux, 1821. Bathonian.

Affinities.—The ovicell appears to much resemble that of *Terebellaria.* As the specimen which we figure is the only ovicelled one we have not dissected it to study the nature of the walls. The placing of this genus in the family Plagioeciidae is therefore possible, although the ovicell in its position shows a resemblance to the Cériocavidae. Certain incompletely developed ovicells of the genus *Ceriocava* have an identical form; and we have found a small rectangular ovicell analogous to that which we figure for *Ceriocava corymbosa* Lamouroux, 1821.

RIPISOECIA CONIFERA Lamouroux, 1821.

Plate 15, figs. 1–8.

1821. *Millepora conifera* Lamouroux, Exposition méthodique des genres de l'ordre des Polypiers, p. 87, pl. 83, figs. 6, 7.

1896. *Heteropora conifera* Gregory, Catalogue fossil bryozoa in the British Museum, Jurassic, p. 202, figs. 19, 20 (Bibliography).

Structure.—Our studies and sections have been made on the two forms *Heteropora ramosa* Michelin, 1846, and *Heteropora reticulata* Haime, 1854. They do not confirm figure 19*a* of Gregory for we have not observed the diaphragms.

The transverse section is that of the zoarial form *Heteropora.* In the center the tubes are of the same size; they are therefore cylindrical. In the periphery the terminal, recurved portion of the tubes is shown through their length; their walls, like those of the mesopores, also are vesicular; their internal surface is striated transversally.

The longitudinal section shows tubes rigorously cylindrical with peripheral gemmation; they are recurved almost at right angles to the zoarial axis at their extremity and their walls are vesicular. The peristome is little salient. The mesopores are irregular; they are rather short and narrow.

In tangential section the mesopores appear to be of a smaller diameter than the tubes and their arrangement is quite variable. The annular canal formed by the parietal vesicles is quite thin.

The mesopores are closed by a very fragile calcareous lamella and specimens with it intact are very rare. The peristome is hardly salient; it is sometimes quite visible.

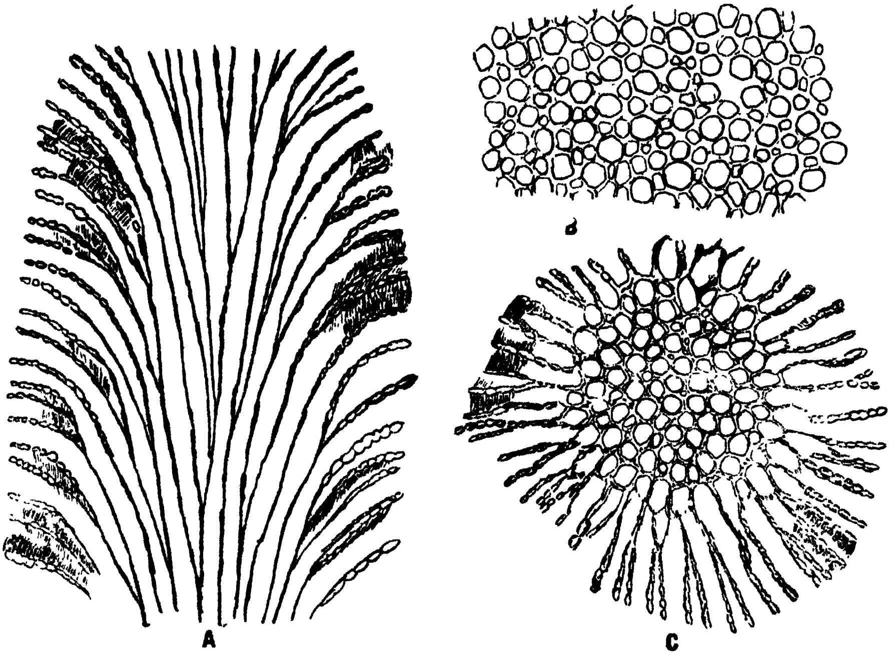


FIG. 23.—Ripisoecia conifera Lamouroux, 1821.

A. Longitudinal section, × 16, showing the vesicular walls of the recurved portion.

B. Tangential section, × 16.

C. Transverse section, × 16.

Jurassic (Bathonian): St. Aubin (Calvados), France.

Occurrence.—Jurassic (Bathonian): St. Aubin (Calvados), France.

Plesiotypes.—Canu collection and Cat. No. 68942, U.S.N.M.

GRAMMECAVA, new genus.

(Greek; *gramme*, line in allusion to the black median line of thin sections.)

The tubes are short, with triparietal gemmation, without peristome; their recurved extremity is much widened and has vesicular walls; they are often closed by a facette bearing an operculate aperture. Gemmation occurs on the basal lamella visible in the transverse sections and on the superior edge of the zoarium.

Genotype.—*Grammecava* (*Ceriopora*) *dumetosa* Michelin, 1846. Jurassic.

GRAMMECAVA DUMETOSA Defrance, 1824.

Plate 16, figs. 1–7.

1824. *Millepora dumetosa* Defrance, Dictionnaire des sciences naturelles, vol. 31, p. 84 (not Lamouroux).

1846. *Ceriopora dumetosa* Michelin, Iconographie Zoophytologique, p. 245, pl. 57, fig. 7.

1854. *Neuropora defrancei* Haime, Description des Bryozoaires fossiles de la formation Jurassique, Mémoires de la Société géologique de France, ser. 2, vol. 5, p. 215, pl. 10, fig. 7.

Historical.—Gregory was in error when in 1896 he classed this species with *Ceriocava corymbosa* Lamouroux, 1821, as the sections which we have prepared indicate a quite different structure. The nature of the tubes is indeed the same, but triparietal gemmation occurs on the basal lamella in the present species.

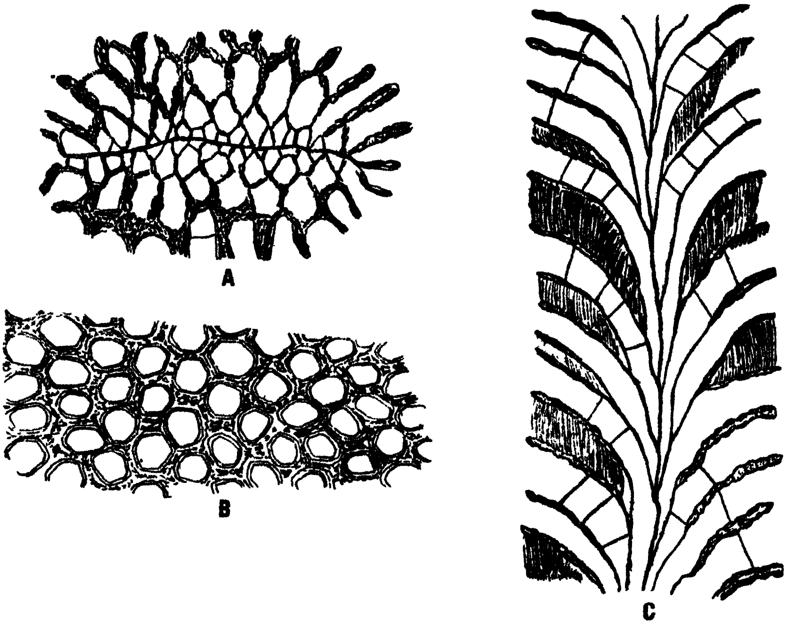


Fig. 24.—Grammecava dumetosa Defrance, 1824.

A. Transverse section, × 16. The median lamella is undulated.

B. Tangential section, × 16.

C. Longitudinal section, × 16, showing the basal (median) lamella, diaphragms in the tubes and the vesicular walls.

Jurassic (Bathonian): Luc (Calvados), France.

Structure.—Exteriorily many of the tubes are closed by a facette. These are perforated by a circular aperture with peristome but always closed by a pseudo-operculum. We have never seen a facetted tube with an open aperture. This phenomenon is inexplicable in the present state of the science. The other tubes have a large polygonal opening.

In transverse section the basal lamella appears as a straight or undulated line. The tubes are polygonal and arranged symmetrically on each side. In the periphery the expanded part of the tubes has hollow vesicular walls.

In longitudinal section the basal lamella is thick. The tubes are short with triparietal gemmation. The inferior part presents a variable number of diaphragms, sometimes close together. The expanded portion of the tube shows vesicular walls and diaphragms variable in position. The orifices being arranged in quincunx, the section is often tangential to the wall of the tube which appears black in all of its concourse.

We have not discovered the ovicell of this species, but all of its features appear to favor its reference to this family.

Occurrence.—Jurassic (Bathonian): Luc and Ranville (Calvados), France.

Plesiotypes.—Canu collection and Cat. No. 68943, U.S.N.M.

Genus HAPLOOECIA Gregory, 1896.

1896. *Haplooecia* GREGORY, Catalogue of fossil Bryozoa in the British Museum, Jurassic, p. 157.

The characters of this genus are noted in the following description of the genotype.

Genotype.—*Haplooecia straminea* Phillips, 1829. Jurassic.

HAPLOOECIA STRAMINEA Phillips, 1829.

Plate 14, figs. 14, 15.

1896. *Haplooecia straminea* GREGORY, Catalogue of the fossil Bryozoa in the British Museum, Jurassic p. 159, figs. 11, 12.

We have not discovered the ovicell of this species, and our present studies are based upon thin sections, which permit the reference of the genus to the Ceriocavidae. In longitudinal section the tubes are analogous to those of *Ceriocava.* They are long, cylindrical in their rectilinear part, and much expanded in their recurved portion. Gemmation is peripheral, and the zoarial axis appears to be occupied by a tube which branches at the bifurcations. The terminal walls are hollow, but not vesicular, as in *Ceriocava.* In transverse sections the tubes are polygonal, and those of the periphery alone have hollow walls.

Exteriorly the facettes are elliptical, little distinct, separated by a furrow of little depth. The aperture is terminal, orbicular or somewhat transverse, without peristome.

So far as we are able to judge now, the genus *Haplooecia* Gregory, 1896, differs from the preceding new genus *Ripisoecia* in the absence of mesopores and in its terminal aperture. It differs from *Ceriocava* D'Orbigny, 1852, in its terminal aperture, in the great constancy of the facettes, and in the absence of diaphragms in the tubes. It differs from the new *Grammecava* in the absence of the basal lamella and in the different mode of gemmation. All the known members of the family have therefore tubes provided with facettes, without peristome, of the group for which Marsson proposed the term Metoporina.

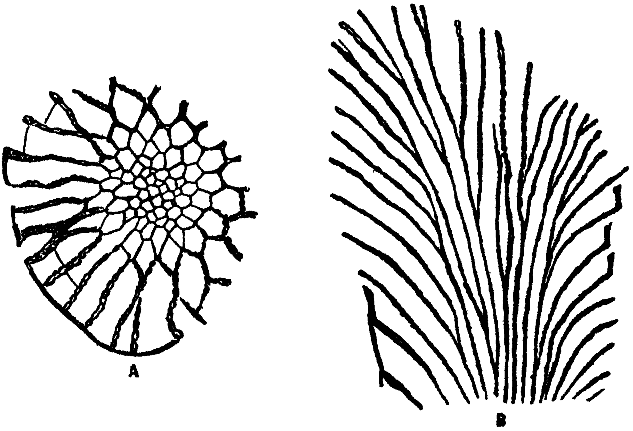


Fig. 25.—Haplooecia straminea Phillips, 1829.

A. Portion of a transverse section, × 12. The partitions in some of the tubes are accidental and are not diaphragms.

B. Longitudinal section, × 12, with some tubes showing the aperture and facette.

Jurassic (Bathonian): Ranville (Calvados), France.

Occurrence.—Jurassic (Bathonian): Ranville (Calvados), France.
Plesiotypes.—Canu collection and Cat. No. 68949, U.S.N.M.

Family LEIOSOECIIDAE Canu and Bassler, 1920.

1920. Leiosoeciidae Canu and Bassler, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 823.

This family is well characterized by its smooth orbicular ovicell placed above and obstructing a number of the tubes but not perforated by them.

In addition to *Leiosoecia* and *Parleiosoecia* Canu and Bassler 1920 we are now able to place the ancient genera *Ditaxia* Hagenow 1851 and *Chilopora* Haime, 1854 in this family.

Genus LEIOSOECIA Canu and Bassler, 1920.

1920. *Leiosoecia* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 823.

Zoarium consisting of cylindrical tubes and regular, parietal mesopores.

The genotype, although figured by us in 1920, was not described, so that we have added notes concerning it below.

Genotype.—Leiosoecia (*Multicrescis*) *parvicella* Gabb and Horn. Cretaceous of New Jersey.

LEIOSOECIA CONSTANTII D'Orbigny, 1850.

1841. *Heteropora dichotoma* MICHELIN, Iconographie zoophytologique, p. 4, pl. 1, fig. 11 (not Goldfuss, 1830).

1850. *Ceriopora constantii* D'ORBIGNY, Prodrome de paléontologie stratigraphique, vol. 7, p. 143.

1854. *Heteropora constantii* D'ORBIGNY, Paléontologie française, Terrain Crétace, vol. 5, p. 1071, pl. 799, fig. 6, 7.

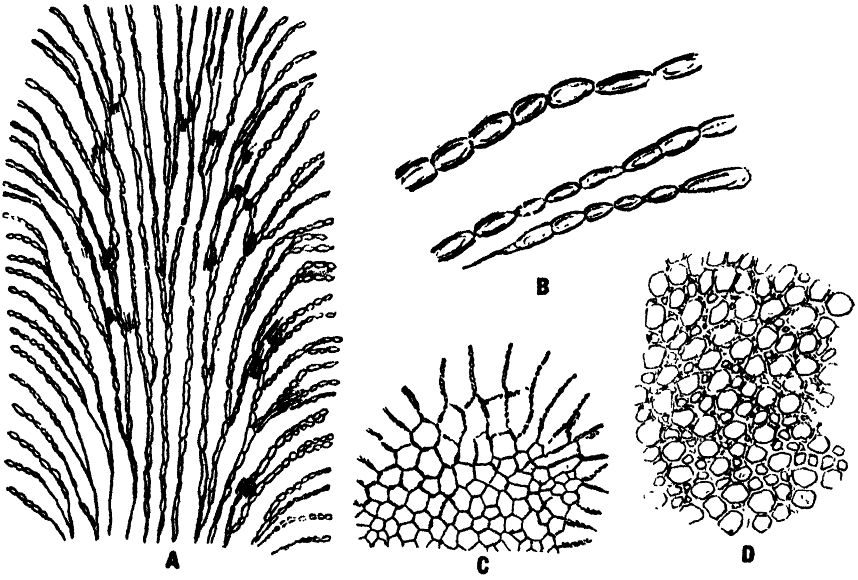


FIG. 26.—Leiosoecia constantii D'Orbigny, 1850.

A. Longitudinal section, × 16, showing the cylindrical tubes with vesicular walls.

B. Portion of the same section, × 65, exhibiting the vesicular structure in more detail.

C. Part of a transverse section, × 16.

D. Tangential section, × 16.

Lower Cretaceous (Aptian): Ervy, France.

We have discovered the ovicell of this species; it is not good enough to be figured, but it undoubtedly belongs to this genus because all the ovicells of the genus resemble each other.

The tubes are cylindrical, with vesicular walls; they ramify at all heights. The shorter are closed by a calcareous membrane and are thus transformed into dactylethrae little numerous and appearing between the tubes in the tangential sections.

The vesicular walls of the tubes are absolutely similar to those which Waters, 1904, has figured for *H. claviformis* of recent seas.

Occurrence.—Lower Cretaceous: Albian of Grandpré (Ardennes) (D'Orbigny); Aptian of Ervy, France (Canu collection).

Plesiotype.—Cat. No. 68960. U.S.N.M.

LEIOSOECIA PARVICELLA Gabb and Horn, 1860.

1860. *Multicrescis parvicella* Gabb and Horn, Descriptions of new Cretaceous corals from New Jersey, Proceedings, Academy of Natural Sciences, Philadelphia, p. 367.

1860. *Multicrescis parvicella* Gabb and Horn, Descriptions of new species of American Tertiary and Cretaceous fossils, Journal Academy of Natural Sciences, Philadelphia, ser. 2, vol. 4, p. 401, pl. 69, figs. 36–38.

1862. *Multicrescis parvicella* Gabb and Horn, Monograph of fossil Polyzoa of Secondary and Tertiary formations of North America, Journal Academy of Natural Sciences Philadelphia, ser. 2, vol. 5, p. 178, pl. 21, fig. 70.

1907. *Heteropora parvicella* Ulrich and Bassler, Cretaceous Paleontology of New Jersey, Geological Survey, New Jersey, Paleontology, vol. 4, p. 327, pl. 23, figs. 1, 2.

1920. *Leiosoecia parvicella* Canu and Bassler, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 824, fig. 273.

Although figured in our work of 1920, this species was not described, and we therefore take the present opportunity to give a few notes concerning it.

The tubes are cylindrical, with peripheral gemmation (by bifurcation), very irregular. The ovicell is globular, salient, orbicular, surrounding five or six aborted tubes; the walls are smooth.

This species is so irregular that we have not been able to obtain a good longitudinal section, so that we do not know exactly the nature of the adventitious pores; according to the fractured specimens and tangential section, they appear to be mesopores of equal length.

Occurrence.—Cretaceous (Vincentown): Vincentown, New Jersey.

Plesiotype.—Cat. No. 68950, U.S.N.M.

LEIOSOECIA OCCLUSA, new species.

Plate 22, figs. 16, 17.

Description.—The zoarium is free, claviform; it seems exteriorly to be formed by many superposed subcolonies. The walls of the tubes are thin; the apertures are large and polygonal. The ovicell is orbicular, deeply embedded, a little convex. An epitheca partially closes certain zones of apertures.

Measurements.—
Diaeter of apertures .... 0.22–0.26 mm.
Diameter of ovicell .... .80 mm.
Length of zoarium .... 15.00 mm.

Affinities.—Another specimen in the Canu collection is claviform without an enlarged inferior part; its dimensions are identical and it bears groups of closed zooecia.

Our species appears to resemble the figure of *Radiopora inflata* Simonovitsch, 1871, but Gregory, in 1909, confirms the *Radiopora* character of this species, which, however, scarcely appears on the author's figure.

Occurrence.—Cretaceous (Cenomanian): Essen, Germany.

Holotype.—Cat. No. 68951, U.S.N.M.

Genus DITAXIA Hagenow, 1851.

1851. *Ditaxia* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 49.

Leiosoeciidae in which the tubes are short, cylindrical, with triparietal gemmation on a thick median lamella. They are recurved at their extremities with irregularly thickened walls. The peristomes are slightly salient in young specimens but absent in the mature stages. The mesopores are little abundant, cylindrical or club-shaped, of variable length.

Genotype.—*Ditaxia anomalopora* Goldfuss, 1827.

Range.—Coniacian—Danian.

Historical.—Hagenow considered the great thickness of the median lamella as the essential character of his genus. Pergens in 1889 applied the name to all species provided with club-shaped tubes and with mesopores. Gregory classed the genus in his family Clausidae, characterized by the presence of dactylethrae (or aborted cellules). The accessory cellules being the superior ramifications of the normal tubes are mesopores and not dactylethrae. The diagnosis of Hagenow's genus must therefore be reestablished as above after a study of thin sections of the genotype. It differs from *Chilopora* Haime, 1854, in its much larger ovicell in the presence of a very thick median lamella and in the considerable thickening of the extremity of the tubes.

DITAXIA ANOMALOPORA Goldfuss, 1827.

Plate 17, figs. 9-13.

1827. *Ceriopora anomalopora* GOLDFUSS. Petrefacta, Germania, vol. 1, p. 33. pl. 10, figs. *c*, *d*, (not *a*, *b*).

1899. *Ditaxia anomalopora* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 406; vol, 2, p. 309 (cites bibliography).

We are not certain that the species figured by D'Orbigny in 1852 is exactly that of Goldfuss, and there is a great confusion in his collection in this respect. The geologic distribution given by Gregory appears to be erroneous.

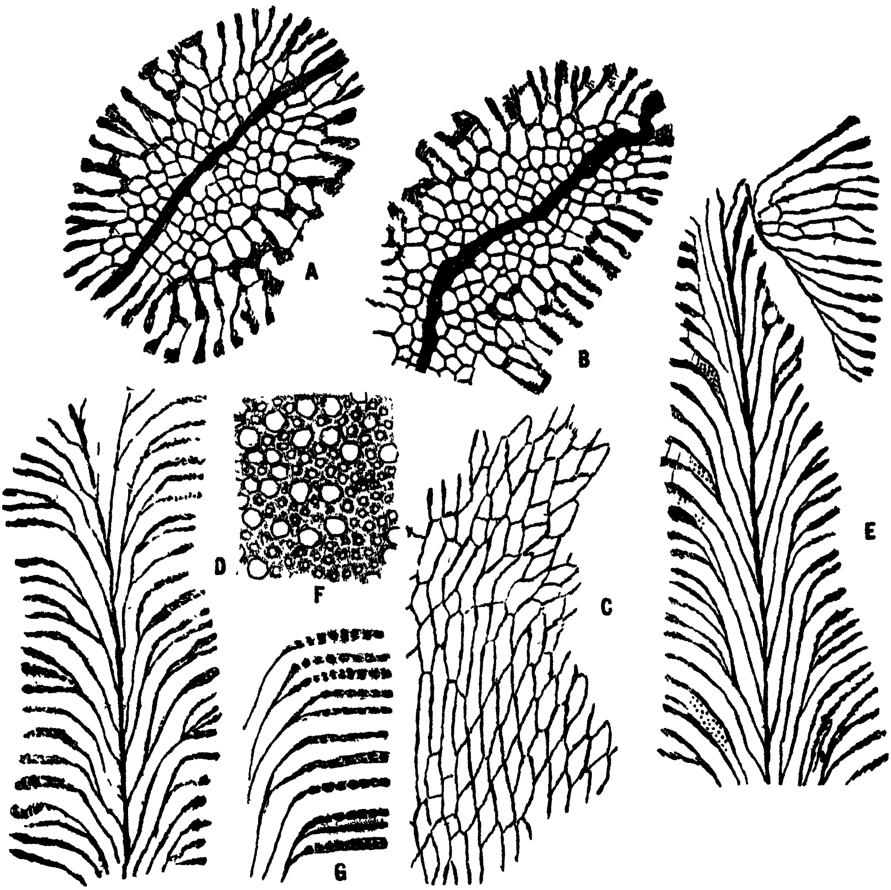


FIG. 27.—Ditaxia anomalopora Goldfuss, 1827.

A. Transverse section, × 16, with the median lamella almost rectilinear.

B. A similar section, × 16, with undulated median lamella.

C. A meridian section, × 16, cutting just above the median lamella.

D. Typical longitudinal section, × 16, showing the short tubes.

E. Another longitudinal section, × 16, showing a unilamellar expansion commencing to cover the frond.

F. Tangential section, × 16, illustrating zooecia and thick walled mesopores.

G. Portion of a longitudinal section of well developed frond, × 16, exhibiting the vesicular wall structure.

Cretaceous (Maastrichtian): Maastricht, Holland.

Structure.—We have not yet had the good fortune to discover an ovicell of this species well enough preserved to be photographed, but its place in the family Leiosoeciidae appears to us not to be doubted.

In longitudinal section the tubes are short, cylindrical, recurved at their extremity. The gemmation is triparietal, the third wall being that of a very thick basal lamella. The specimens being bilamellar, this latter is often visible as a median lamella. The mesopores are very short, expanded; their walls and also those of the tubes in their recurved portions are moniliform.

In transverse sections the tubes are all equal and in consequence cylindrical. There are no smaller tubes adjacent to the median lamella, and the gemmation is therefore triparietal. The median lamella is very thick, undulated or sinuous, rarely rectilinear.

In meridian sections the tubes have the usual lozenge shape.

The exterior aspect is quite variable. One characteristic of this species is that unilamellar expansions often incrust the bilamellar frond. Well preserved young specimens have a slightly salient, oblique peristome, in this respect resembling *Chilopora* but the older specimens strongly calcified lack the peristome. Certain fronds exhibit large irregular spaces composed of mesopores alone. The diameter of the orifices is 0.08 to 0.10 mm., and that of the mesopores, 0.02–0.04 mm.

The young fronds grow distally and laterally. Their transverse section is traversed entirely by the median lamella. Other fronds growing solely at their distal extremity have the median lamella completely surrounded by tubes.

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland.

Plesiotypes.—Cat. No. 68952, U.S.N.M.

DITAXIA PARVIPORA, new species.

Plate 17, figs. 1–8.

1900. *Ditaxia anomalopora* CANU, Note préliminarie sur les Bryozoaires de Tours, Comptes Rendus Association française Avancement Science, sess. 2, p. 409.

Description.—The zoarium is free, bilamellar, formed of much compressed, flabelliform, branching fronds. The tubes are short, cylindrical, without peristome, of small diameter, with triparietal gemmation, recurved at their extremity where the walls are thickened. The mesopores are small, quite short, expanded, and as numerous as the tubes. The ovicell is of medium size, smooth, convex, subround, its contours indefined; the oeciopore is very small and central.

Measurements.—		
	Diameter of tubes	0.08 mm.
	Width of fronds	3.00 to 5.00 mm.

Structure.—At the surface it is difficult to distinguish the tubes from the mesopores and the distinction is possible only on very well preserved specimens, but in tangential sections the tubes appear with a larger diameter. The much expanded form of the mesopores is the cause of these differences. The zoarium was probably attached to algae by a slightly expanded base. The median lamella is salient at the extremity of the frond. On the wide fronds of a certain thickness the ovicell is partially covered over by the adjacent mesopores (fig. 7).

In transverse section, the tubes are all equal (hence cylindrical) even in the immediate vicinity of the median lamella (hence triparietal gemmation). The median lamella is rather thick. Our meridian section cuts the branch just before a bifurcation in such a way that a portion is transformed into a longitudinal section. The tubes appear clearly cylindrical, recurved at their extremity where the walls are thickened; gemmation is triparietal. The mesopores are very short and much expanded. On the meridian portion the tubes appear evidently lozenge-shaped. At the base of the section a portion appears in tangential section caused by the undulation of the branch due to ramification.

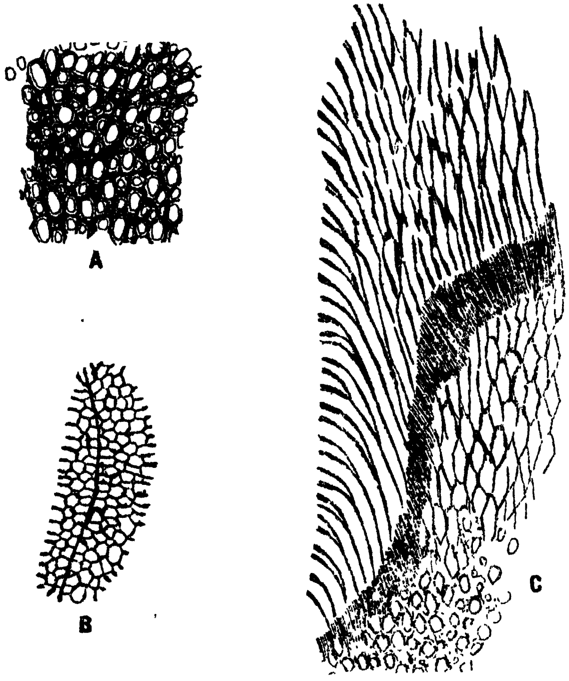


Fig. 28.—Ditaxia parvipora, new species.

A. Tangential section, × 16, showing few mesopores.

B. Transverse section, × 16.

C. Thin section cut obliquely through a zoarium, × 16, illustrating the structure in longitudinal section to the left, the basal lamella in the middle, the median section above and below this, and the tangential section at the bottom.

Cretaceous (Coniacian): Tours (Indre-et-Loire), France.

Occurrence.—Cretaceous (Coniacian): Tours and Saint Paterne (Indre-et-Loire), France.

Cotypes.—Canu collection and Cat. No. 68953, U.S.N.M.

Genus CHILOPORA Haime, 1854.

1854. *Chilopora* HAIME, Description des Bryozoaires fossiles de la formation jurassique, Mémoires de la Société Géologique de France, ser. 2, vol. 5, p. 213.

Leiosoeciidae, in which the ovicell is smooth, convex, very small, opening sometimes by a large oeciopore. The tubes are cylindrical, without peristome, terminated by a salient lip, with triparietal gemmation, much recurved at their extremity, separated by mesopores.

Genotype.—*Chilopora guernoni* Haime, 1854.

Range.—Bathonian, Santonian.

Historical.—Haime created this genus in 1854 for a species having the characters of *Heteropora*, but in which the peristomes are distinct from the intermediate openings and provided inferiorily with a salient lip. This character is not limited to this genus, for it has been found in other species. The thin sections prepared from specimens of the genotype have permitted us to define the characters of the genus more exactly.

CHILOPORA GUERNONI Haime, 1854.

Plate 16, figs. 8–13.

1854. *Chilopora guernoni* HAIME, Description des Bryozoaires fossiles de la formation jurassique. Memoires de la Société Geologique, France, ser. 2, vol. 5, p. 213, pl. 10, fig. 5.

1896. *Chilopora guernoni* GREGORY, Catalogue of the Jurassic Bryozoa in the British Museum, p. 693.

Structure.—The fragments which we have found of this species are very irregular and belonged to very fragile fronds. We still are unable to give an exact idea of the zoarial form. The ovicells are small, appearing arranged longitudinally, and terminated sometimes by a large orifice, which we are not yet certain is a true oeciopore.

On well-preserved specimens the tubes are provided with the lip and the mesopores are distinct and very small. On other specimens the difference is little apparent exteriorly, but it appears clearly in the tangential sections.

In the longitudinal sections the tubes are short, cylindrical, recurved at their extremity, with triparietal gemmation, thin at their origin. The median (basal) lamella is little thickened. The mesopores are short and expanded; their walls are hollow or moniliform. Diaphragms are sometimes present.

In transversal sections there are both large and small tubes adjacent to the median lamella, because the tubes are thin at their base, but the gemmation appears still as triparietal, because in dorsal gemmation there are only small tubes adjacent to the basal lamella.

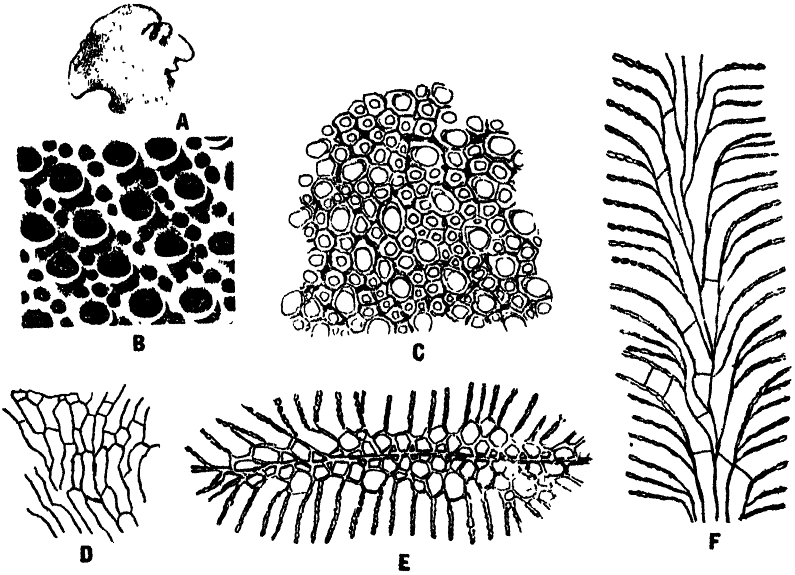


FIG. 29. Chilopora guernoni Haime, 1854.

A, B. The bilamellar zoarium natural size and the surface enlarged (after Haime).
C. Tangential section, × 16.
D. Portion of a meridian section, × 16.
E. Transverse section, × 16, showing the median lamella.
F. Longitudinal section, × 16.
Jurassic (Bathonian): Occaignes (Orne), France.

Occurrence.—Jurassic (Bathonian): Ranville, and Occaignes, France.

Plesiotype.—Canu collection and Cat. No. 68954, U.S.N.M.

CHILOPORA CRETACEA, new species.

Plate 17, figs. 14–16.

Description.—The zoarium is free, formed of compressed, bilamellar fronds, bifurcated, with peripheral growth. The tubes are cylindrical, short, with triparietal gemmation on a slightly thickened basal lamella; they are terminated exteriorly by a salient and triangular superior lip. The ovicell is globular or convex, smooth, quite small. The mesopores are very short and parietal.

Structure.—Without the ovicell, the occurrence of a *Chilopora* in the Cretaceous would have been unperceived; indeed this same species has been confused by Filliozat with *Ditaxia anomalopora* Goldfuss, 1827. The ovicell is globular and convex when it is placed on the zoarial margins; on the fronds it is scarcely convex and is overlapped by the cellular margins according to the rule in the Leiosoeciidae. This difference arises from the peripheral growth of the fronds. The ovicell, at first marginal on the young fronds, becomes more central and more embedded when the fronds grow in width and thickness.

The mesopores are small, but the difference between them and the tubes is visible only in the tangential sections.

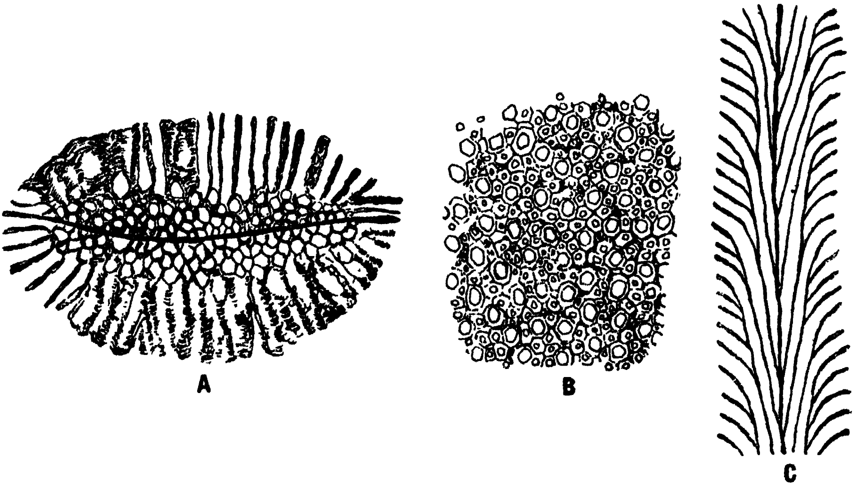


FIG. 30.—Chilopora cretacea, new species.

A–C. Transverse, tangential and longitudinal sections, × 16. Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

In longitudinal sections the tubes are much more regular than in the Jurassic species; they are regular, cylindrical, very little narrowed at their base. The median lamella is thick. The mesopores are short and parietal. On the transverse section the median lamella entirely traverses the preparation, for the growth is peripheral. On the Jurassic species and in the genus *Ditaxia* it is central and never reaches the zoarial margins, for the growth occurs solely on the superior part of the frond.

Occurrence.—Cretaceous (Coniacian); Phellippeaux (Charente), France.

Cretaceous (Santonian): Vendome (Loir-et-Cher) and Bédocheau (Charente), France.

Cotypes.—Canu collection and Cat. No. 68955, U.S.N.M.

Family TRETOCYCLOECIIDAE Canu, 1919.

Rectangulata in which the ovicell is orbicular, flat, smooth, regular and limited, traversed by the tubes and sometimes by adjacent mesopores.

This family corresponds to the Diaperoeciidae in the Parallelata, but differs from it in addition to its axis arranged perpendicularly to the zooecial axis instead of parallel, in the flat orbicular and not globular form of the ovicell, and in the presence of mesopores.

The genera referred to this family at present are as follows:

Tretocycloecia Canu, 1919. Cretaceous–Recent.
Partretocycloecia Canu and Bassler, 1920. Eocene.
Telopora Canu and Bassler, 1920. Recent
Alveolaria Busk, 1859. Pliocene.
Psilosolen, new genus. Pleistocene, Recent.

The simplest genera are the most recent, and the decadence of the Cyclostomata is well shown by the family.

Genus TRETOCYCLOECIA Canu, 1919.

1919. *Tetrocycloecia* (in error for *Tretocycloecia*) CANU, Etudes sur les Ovicelles des Bryozoaires Cyclostomes (2), Bulletin Société Geologique de France, ser. 4, vol. 17, p. 346.

The tubes are cylindrical. The mesopores are irregularly directed; their walls are vesicular. The tubes which perforate the ovicell are accompanied by the adjacent mesopores.

Genotype.—*Tretocycloecia* (*Heteropora*) *dichotoma* Reuss, 1847 (not Hagenow, 1851).

Range.—Midwayan–Recent.

TRETOCYCLOECIA DICHOTOMA Reuss, 1847.

1847. *Heteropora dichotoma* REUSS, Die fossilen Polyparien des Wiener Tertiarbeckens, p. 35, pl. 5, fig. 20.
1877. *Heteropora dichotoma* MANZONI, I Briozoi fossili del Miocene d'Austria ed Ungheria, p. 35, pl. 12, fig. 46.
1859. *Heteropora pustulosa* BUSK, A Monograph on the Fossil Polyzoa of the Crag, p. 122, pl. 19, fig. 6; pl. 20, fig. 1.
1920. *Tretocycloecia dichotoma* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 828, fig. 275.

The studies relative to this species have been made from the specimens collected in France. We are not entirely certain of our determination, for we have never been able to procure Austrian specimens for comparison.

The zoarium is quite variable; massive, reticulate, but more often arborescent and cylindrical.

The tubes are cylindrical, quite long, bifurcating chiefly in the median region at all heights. They are curved at right angles at their extremity. There are numerous diaphragms. The mesopores are rather numerous in the tangential sections and smaller than the tubes. In the longitudinal sections they appear of the same diameter as the tubes and are rarely oriented in the same direction; this results in a complex structure on the zoarial margins which is very difficult to interpret. This phenomenon is not rare, and we have already observed it in Reteporidae; this is the characteristic of divergent mesopores.

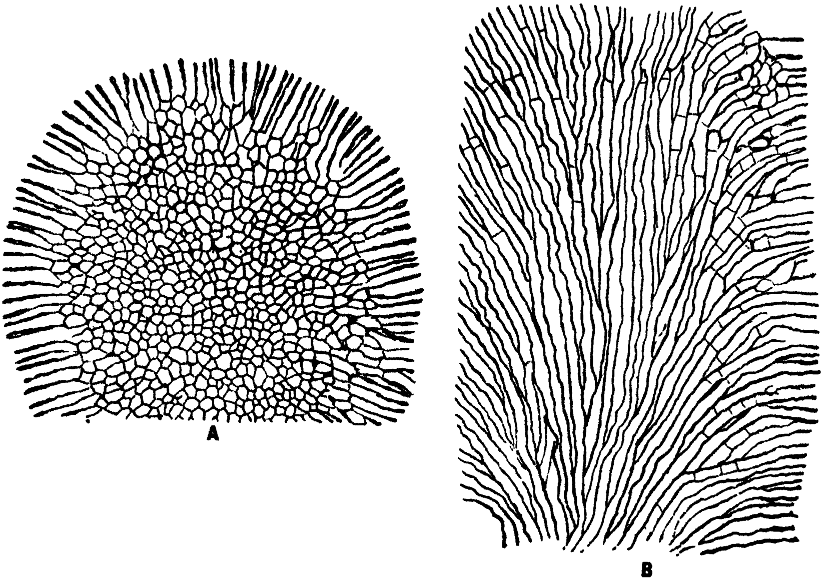


FIG. 31.—Tretocycloecia dichotoma Reuss, 1847.

A. Portion of a transverse section, × 12.
B. Longitudinal section, × 12.
Miocene (Helvetian): Doué-la-Fontaine (Maine-et-Loire), France.

The tubes and the mesopores are polygonal; their walls are not vesicular.

The ovicell is orbicular, little deep, placed on the mesopores. It is perforated by a certain number of tubes accompanied by a row of mesopores. The oeciopore is submedian and of a diameter smaller than that of the tubes.

The zoarium is often formed of many successive lamellae of zooecia. The enveloping lamella is capable of covering the ovicell itself, the fragile wall of which is thus preserved and may be rediscovered.

The peristomes are little salient. On the zoarial surface they are often grouped in radial rows around a hypothetic center.

In spite of its exterior appearance, this species is not *Ceriopora dichotoma* Goldfuss, 1827. Not only the ovicell is quite different, but also the sections are not identical for there is no internal basal lamella.

Occurrence.—Miocene (Helvetian): Doué-la-Fontaine (Maine-et-Loire), France.

Geological distribution.—Tortonian of Austria Hungary (Reuss). Plaisancian of England (Busk).

Plesiotype.—Canu collection and Cat. No. 68956, U.S.N.M.

TRETOCYCLOECIA (HETEROPORA) PELLICULATA Waters, 1879.

Plate 13, figs. 9, 10.

1910. *Heteropora pelliculata* ROBERTSON, Cyclostomatous Bryozoa of the West Coast of North America, University of California publications, vol. 6, p. 258, pl. 25, figs. 51–55 (bibliography).

1920. *Heteropora pelliculata* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106 U. S. National Museum, p. 681, figs. 222, J, K, L (sections).

In 1920 we published thin sections of this species, and we are now able to illustrate its ovicell, showing it to belong to the genus *Tretocycloecia.* At the extremity of the tubes the walls are vesicular; the vesicles are small and visible in tangential sections. The tubes are cylindrical with peripheral gemmation.

The ovicell is that of *Tretocycloecia*, but more irregular. We still have no knowledge of the anatomical details of this species, and it is hoped that living specimens will soon be dredged, so that we will be able to complete our studies of this remarkable genus in which the fossil representatives are very numerous.

Occurrence.—Recent: Japan, Australia, New Zealand, etc. Our specimens are from Neah Bay, Washington.

Plesiotypes.—Cat No. 7377, U.S.N.M.

TRETOCYCLOECIA SABAUDICA, new species.

Plate 18, figs. 5–9.

Description.—The zoarium is large, free, reticulate, with short, cylindrical branches growing in all directions. The tubes are cylindrical; the peristome is thin and little salient. The mesopores are numerous and often closed by a calcareous lamella. The ovicell is large, orbicular, little convex, surrounding a large number of tubes.

Occurrence.—Cretaceous (Greensand): Chamboy (?France). Type collected by Carl Rominger many years ago at a now unlocated locality marked Chamboy.

Holotype.—Cat. No. 68958, U.S.N.M.

Genus ALVEOLARIA Busk, 1859.

1859. *Alveolaria* BUSK, Monograph Fossil Polyzoa of the Crag, Publications Paleontographical Society, London, vol. 14, p. 128.

The tubes are cylindrical; mesopores are absent. The zoarium is an aggregation of cup-shaped bodies adjacent to each other by their basal lamella. The ovicell is irregular, not salient, placed at the center of each subcolony.

Genotype.—*Alveolaria semiovata* Busk, 1859. Plaisancian.

ALVEOLARIA SEMIOVATA Busk, 1859.

Plate 18, Figs, 1–4.

1859. *Alveolaria semiovata* BUSK, Monograph Fossil Polyzoa of the Crag, Publications Paleontological Society, London, vol. 14, p. 128.

Busk has very well described and figured the structure of this genus and species and we here can only add some additional notes from the study of thin sections. Each subcolony is a sort of bowl covered exteriorly with a basal lamella (epitheca of D'Orbigny). The tubes are cylindrical and adjacent on the entire length of their concourse. They grow by dorsal gemmation in the vicinity of the basal lamella and by peripheral budding in the middle of each subcolony. Diaphragms are present.

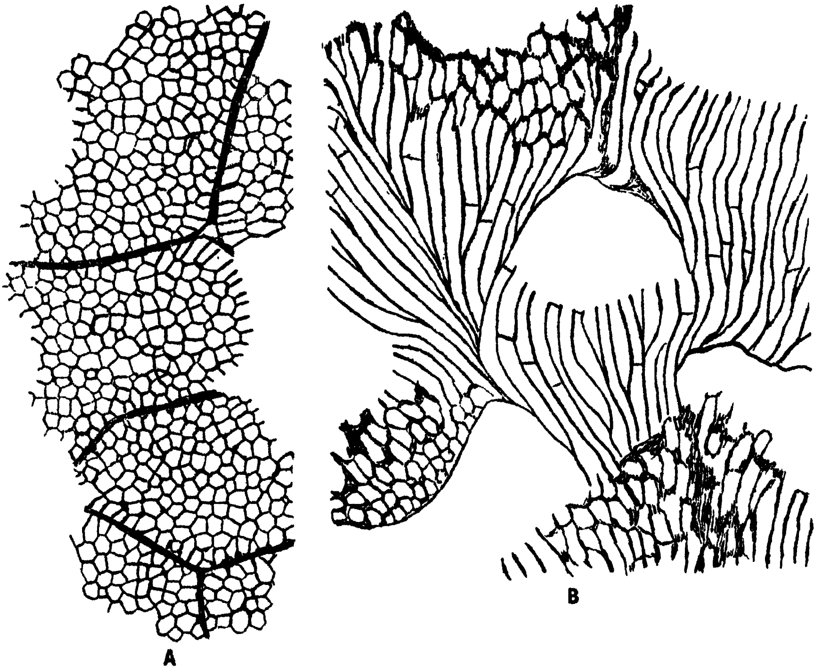


FIG. 32.—Alveolaria semiovata Busk, 1859.

A. Transverse section, × 16.

B. Longitudinal section, × 16, through several subcolonies.

Pliocene (Plaisancian): Sudbourne Church, Suffolk, England.

The ovicell is of the exact type of the Tretocycloeciidae; the tubes which perforate it are often closed by a calcareous lamella. The zoaria of *Psilosolen* differ from *Alveolaria* only in a more elongated form of the branches and in the absence of dorsal budding. *Alveolaria* is an aggregation of non-digitate colonies like *Telepora* Canu and Bassler 1920. When we know the internal structure of this latter genus from thin sections it may perhaps be necessary to unite it with *Alveolaria.*

Occurrence.—Pliocene (Plaisancian) : Sudbourne Church, etc., Suffolk, England.

Plesiotypes.—Cat. No. 60363 U.S.N.M.

PSILOSOLEN, new genus.

Psilos-unfurnished and *solen*, tube.

Tretocycloeciidae in which there are no adventitious tubes. The tubes are cylindrical, with peripheral gemmation.

Genotype.—*Psilosolen capitiferax*, new species.

Range.—Pleistocene, Recent.

The ovicell is a swelling perforated by the tubes as in the Diaperoeciidae, but it is not inserted in the tubes themselves. On the contrary, the ovicell is perpendicular to the tubes and surrounds only the peristomes, as in the family Tretocycloeciidae, where this new genus may be naturally classed. The ovicell is little convex and very different from the elongated and very salient sac of the Ascosoeciidae.

It is remarkable to note again that through the geological ages it is the simplest form of the family that has persisted. The Cretaceous and Tertiary genera of this family are more complicated and provided with adventitious tubes.

PSILOSOLEN CAPITIFERAX, new species.

Plate 13, fig. 8.

Description.—The zoarium is free, with the form of *Entalophora*, more or less compressed, dichotomous; the extremity of the branches is enlarged, flattened, and *bears the ovicell.* The tubes are visible, separated by a furrow, convex, wrinkled transversely, somewhat widened at the summit; the peristome is thin, salient, elliptical or suborbicular. The ovicell is a swelling covering the extremity of a branch; it is perforated by a dozen tubes, some of which are closed by a finely porous diaphragm.

Measurements.—	Diameter of peristome	0.16–0.18 mm.
	Distance between peristomes	.50–1.35 mm.
	Diameter of orifice	.12 mm.
	Separation of peristomes	Variable.
	Diameter of tube	.18– .20 mm.

Structure.—The internal structure of this species is described and illustrated in detail in our volume on the Later Tertiary and Quaternary Bryozoa of North America now in press. The ovicell, located at the end of the branch, is not very salient. It is hollowed out of the zoarium itself, as is easy to verify in the sections.

Affinities.—Our species is almost identical with *Entalophora capitata* Robertson, of whose variations we are ignorant. It differs from it in its ovicell, which completely covers the end of the branch, and in the smaller micrometric dimensions (if the enlargement indicated on Miss Robertson's figures is exact).

Occurrence.—Pleistocene: Santa Barbara (very common) and Dead Mans Island (rare), California.

Cotypes.—Cat. No. 68959, U.S.N.M.

Family ASCOSOECIIDAE Canu, 1919.

1919. Ascosoeciidae CANU, Etudes sur les Ovicelles des Bryozoaires Cyclostomes (2), Bulletin Société Geologique de France, ser. 4, vol. 17, p. 336.

The ovicell is a large, elliptical, elongate swelling, quite salient and perforated by the tubes; often a median oeciopore is present.

In addition to the genus *Ascosoecia*, *Parascosoecia*, and *Polyascosoecia* described under this family in our monograph of 1920, we are now able to refer the following genera to it: *Sulcocava* D'Orbigny, 1850; *Filicrisina* D'Orbigny, 1852; *Cavarinella* Marsson, 1884, and the new genera *Grammascosoecia* and *Grammanotosoecia*.

The Ascosoeciidae and Cytisidae are perhaps the two principal families of Cretaceous cyclostomatous bryozoa, as the seas of that time abounded in their species. The Cytisidae is entirely extinct, while the Ascosoeciidae existed, greatly diminished, during the Cenozoic and are rarely found in recent seas.

KEY FOR DETERMINATION OF GENERA OF ASCOSOECIIDAE.

1.	Gemmation triparietal	2.
	Gemmation biparietal	4.
2.	Median lamella	*Grammascosoecia.*
	No median lamella	3.
3.	Vacuoles on the dorsal; mesopores on the frontal	*Polyascosoecia.*
	No frontal mesopores. The walls of the tubes are very thick at their extremities	*Crisina.*
4.	Tubes cylindrical	5.
	Tubes conical	6.
5.	Mesopores only	*Ascosoecia.*
	Mesopores and vacuoles	*Reteporidea.*
6.	No mesopores, Sulci present	*Sulcocava.*
	Mesopores regular (parietal)	*Parascosoecia.*
7.	No mesopores: dorsal dactylethrae	*Filicrisina.*
	No mesopores: peripheral sulci	*Sulcocava.*

Genus PARASCOSOECIA Canu, 1919.

1920. *Parascosoecia* CANU and BASSLER, North American Early Tertiary Bryozoa, Bull. 106, U. S. National Museum, p. 840. (Give description and illustration.)

PARASCOSOECIA CICATRIX Gregory, 1899.

1899. *Sparsicavea cicatrix* GREGORY, Catalogue of Cretaceous Bryozoa, p. 391, fig. 52.

1897. *Peripora pseudospiralis, Heteropora clava, Heteropora obliqua*, CANU, Bryozoaires du Turonian de St. Calais, Bulletin Société geologique de France, ser. 3, vol. 25, pp. 746, 747.

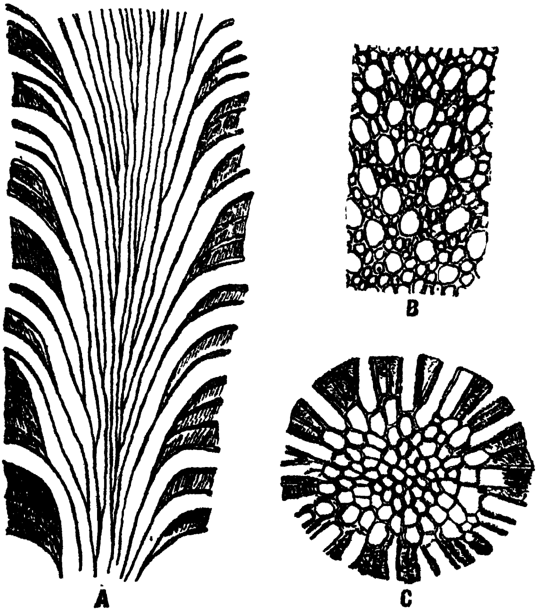


FIG. 33.—Parascosoecia cicatrix Gregory, 1899.

A. Longitudinal section, × 16.
B. Tangential section, × 16.
C. Transverse section, × 16.
Cretaceous: Rullié Poncé (Loir-et-Cher), France.

The very great variations of this species explain Canu's errors in determination. The pellicule which closes the mesopores disappears often in fossilization, and the specimens have then most fantastic aspects.

In 150 specimens from Canu's collection but one ovicell has been found.

The authors (Gregory, Novak, etc.) have given to the mesopores of this zoarial form, *Sparsicavea*, a too great regularity and a general aspect which does not correspond to the reality observed in thin sections. A simple, longitudinal section causes two thick lateral walls to appear perforated by the mesopores. This is an optical illusion caused by the relative regularity of the mesopores and the great thickness of their walls. We have called these structures parietal mesopores.

Pergens, in 1889, observed the identity of the mesopores of *Sparsicavea* with those of *Heteropora* and classified all the species in the latter genus. He found it necessary since to separate them, because in *Sparsicavea* the tubes are club shaped.

In the form of the ovicell this species must be classified in the Ascosoeciidae.

Occurrence.—Cretaceous (Upper Turonian or Angoumian) : Ruillé-Poncé (Loir-et-Cher), Les Janieres and St. Calais (Sarthe), France (Canu collection).

Geological distribution.—Turonian and Coniacian of France (Gregory).

Plesiotypes.—Cat. No. 68978, U.S.N.M.

PARASCOSOECIA MARSSONI Gregory, 1899.

Plate 19, fig. 11.

1887. *Sparsicavea irregularis* MARSSON, Die Bryozoen der weissen Schreibkreide der Insel Rügen, Palaeontologische Abhandlungen, vol. 4, p. 26, pl. 2, fig. 6 (not d'Orbigny).

1899. *Sparsicavea marssoni* GREGORY, Catalogue of Cretaceous Bryozoa in British Museum, vol. 1, p. 397; 1909, vol. 2, p. 304 (Synonymy).

We have discovered a superb ovicelled specimen of this species which is figured on plate 19.

Occurrence.—Cretaceous (Danian) : Herfolge (Seeland), Denmark.

Geological distribution.—Cretaceous (Campanian) : Island of Rügen, Germany.

Plesiotype.—Cat. No. 68961, U.S.N.M.

PARASCOSOECIA FRANCQANA D'Orbigny, 1852.

Plate 19, fig. 12.

1852. *Sparsicavea francqana* D'ORBIGNY, Paleontologie française, Terrain Crétacé, Bryozoaires, p. 951, pl. 775, figs. 4–6.

The ovicell of this species measures 1.35 mm. by 0.66 mm. Gregory, 1899, was in error in uniting the species with *Sparsicavea carantina* D'Orbigny, 1852.

Occurrence.—Cretaceous (Danian) : Herfolge (Seeland), Denmark.

Geological distribution.—Cretaceous (Senonian) : Département du Nord, France.

Plesiotype.—Cat. No. 68962, U.S.N.M.

Genus CRISINA D'Orbigny, 1852.

1852. *Crisina* D'ORBIGNY, Paleontologie française, Terrain Crétacé, vol. 5, p. 912.

1887. *Crisidmonea* MARSSON, Bryozoen der weissen Schreibkreide der Insel Rügen, Paleontologische Abhandlungen, vol. 4, p. 30.

The ovicell is a globular sac, very salient, unsymmetrical, inclosing the opposite lines of each side of the median crest on almost all of the zoarial width. The inclosed peristomes are more salient and larger. The tubes are short, club shaped, with triparietal gemmation; their calcareous walls are very thick at their extremity. The dorsal is very thick, of lamellar structure, and perforated by scattered vacuoles.

Genotype.—*Crisina normaniana* D'Orbigny, 1852.

Range.—Cenomanian-Campanian.

This genus is very close to *Polyascosoecia* and differs in its ovicell covering all the zooecial width, in the absence of frontal mesopores, and in its short club-shaped tubes with dilated walls.

The structure of the genus *Crisidmonea* Marsson, 1887, is identical, but its ovicell is not known.

The known species are: *Crisina normaniana* D'Orbigny, 1850; *C. triangularis* D'Orbigny, 1851; *Crisina subgradata* D'Orbigny, 1850; *Crisidmonea macropora* Marsson, 1887; *Idmonea prima* Pocta, 1892; and *I. cretacea* Milne-Edwards, 1838.

The genus *Crisina* of D'Orbigny is also one which has been poorly interpreted by the authors who have succeeded him and which it is necessary to reestablish within the exact limits fixed by the French paleontologist. His definition is as follows: "Colonie fixe par sa base, d'où partent des rameaux libres, anguleux, divisés par des dichotomisations sur le même plan, représentant un ensemble dendroïde. Chaque branche est mince en dessus, de chaque côté, de lignées transversales de cellules, occupant chacune un des côtés, et alternant entre elles au milieu. Le dessous offre, par lignes longitudinales, des pores opposés plus ou moins larges, non saillants et souvent dans des fossettes longitudinales. L'accroissement a lieu seulement à l'extrémite des rameaux par des germes de cellules; quelquefois des vésicules ovariennes sur le côté des rameaux sous forme de boursouflures."

D'Orbigny did not wish to classify in this genus all the Idmoneas provided with pores of whatever nature on the reverse. The three species which he has described are provided with widely spaced pores (vacuoles) placed at the base of longitudinal fossettes (sulci). The sections which we have made of *Crisina triangularis* and *normaniana* confirm entirely this interpretation of his text.

D'Orbigny has classified in the same genus three species of Reuss not provided with sulci and only from an examinataion of the figures.

This unfortunate generalization has encouraged Pergens, Stoliczka, and others to give to the genus a much broader sense, and they have not taken into account the nature of the pores. But one must not forget that D'Orbigny made an attempt at a general classification and his generic definitions alone have an exact value.

In 1899 Gregory generalized further. He applied the term *Crisina* to that group which the zoologists have always called *Idmonea*, on the pretext that the pores have no morphological value. It is evident that the pores have not a great value of classification, but they have some value, for they are never replaced one by the other, and in a given species their form and their presence are constant.

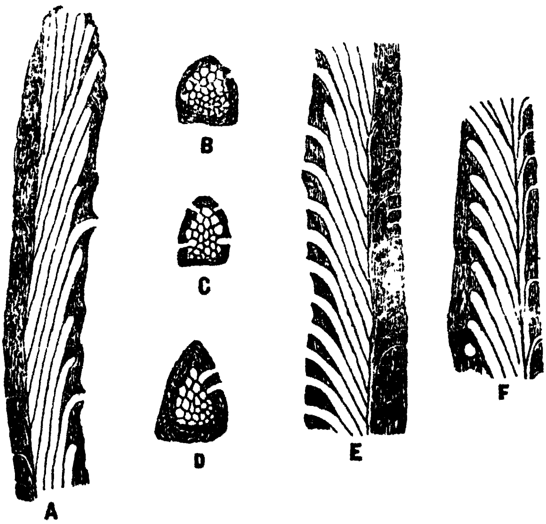


FIG. 34.—Genus Crisina D'Orbigny, 1852.

A–C. Longitudinal section, × 16, of Crisina normaniana D'Orbigny, 1852, (A) and transverse sections, × 16 (B, C).

Cretaceous (Coniacian): Fecamp (Seine inferieure), France.

D–F. Transverse section, × 16, of C. triangularis D'Orbigny, 1851 (D), and longitudinal sections, × 16, one (E) in the middle of a branch, the other (F) through the extremity of a branch and showing the origin of the vacuoles.

Cretaceous (Coniacian): Tours (Indre-et-Loire), France.

We have discovered the ovicell of *Crisina normaniana* D'Orbigny, 1852, and find it is of the type of *Ascosoecia*.

Summarizing the genus *Crisina* D'Orbigny, 1850, is perfectly limited by his definition, its ovicell, and the internal structure. Among the species cited by D'Orbigny, *Retepora lichenoides* is a member of our genus *Polyascosoecia*, and the species of Reuss are incompletely studied. Those which are described and figured in Paleontologie française are of the *Ascosoecia* type.

CRISINA NORMANIANA D'Orbigny, 1852.

Plate 20, figs. 9–14.

1852. *Crisina normaniana* D'ORBIGNY, Paleontologie française, Terrain Crétacé, vol. 5, p. 914, pl. 612, figs. 1–5.

D'Orbigny's figure is perfectly exact. The dorsal is usually ornamented with three sulci alone. The zoarium is much smaller than that of *Crisina triangularis.*

D'Orbigny's figured type came from Fecamp, which has yielded our figured specimens also. The ovicell has been discovered in the material coming from a geode. This remarkable locality, extraordinarily rich in bryozoa, is celebrated for its geodes of flint; on breaking these their interior shows multitudes of bryozoa and sponge spicules, admirably preserved.

This ovicell is globular and of the type of *Ascosoecia;* it incloses the transverse and opposite lines on the full zoarial width. The peristomes are longer, larger, and are not so adjacent, exhibiting therefore the same structure as in the genus *Polyascosoecia.* The only difference is in the position occupied by the ovicell.

The sections are identical with those of *Crisina triangularis* D'Orbigny, a larger and more easily sectioned species.

Occurrence.—Cretaceous (Coniacian): Fecamp (Seine inférieure), France.

Plesiotypes.—Canu collection and Cat. No. 68963, U.S.N.M.

CRISINA TRIANGULARIS D'Orbigny, 1851.

Plate 20, figs. 15–21.

1851. *Crisina triangularis* D'ORBIGNY, Paleontologie française, Terrain crétacé, vol. 5, Bryozoaires, p. 915, pl. 612, figs. 11–15; pl. 769, figs. 11–14.

1851. *Crisina ligeriensis* D'ORBIGNY, Paleontologie française, Terrain crétacé, vol. 5, p. 265, pl. 614, figs. 11–15.

1899. *Retecava cretacea* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, pl. 9, fig. 8 (not synonymy).

Gregory identified this species with *Idmonea cenomana* D'Orbigny, 1851. This is incorrect, as is also his synonomy. However, he gives a figure under the name *Retecava cretacea*, which does not correspond at all to the text and which, if it is correct, represents *Crisina triangularis.* The Canu collection contains a great number of D'Orbigny's species, collected at the same localities. Their study shows that Gregory's synonymy for *Crisina triangularis* and for *Retecava cretacea* is absolutely incorrect. The figures of D'Orbigny are very accurate for the present species, and there is little to be added to his description.

In vertical section the tubes are short with peristome, with triparietal gemmation, oriented, somewhat club shaped; the walls are much dilated at their extremity, forming a thick frontal. The dorsal is very thick, of lamellar structure, and perforated by the scattered vacuoles. These latter appear to come from either side of the basal lamella.

In transverse section the zoarial walls are very thick; the tubes are almost equal, the smallest being in the vicinity of the dorsal.

The sulci of the dorsal disappear in tangential sections. These latter show that the calcification operates by very fine and juxtaposed calcareous elements in each lamella. The structure of the zoecial walls on the frontal is identical.

Occurrence.—Cretaceous (Coniacian): Tours (Indre-et-Loire), St. Paterne et Villedieu (Loire-et-Cher), France.

Geologic distribution.—Coniacian, Santonian, Campanian, and Maastrichtian of France (D'Orbigny, Pergens).

Plesiotypes.—Canu collection and Cat. No. 68964, U.S.N.M.

GRAMMASCOSOECIA, new genus.

(Greek: *gramme*, line, in allusion to the black median line of transverse sections.)

The ovicell is a large suborbicular sack. The tubes are cylindrical, short, without peristome, with dorsal gemmation. The mesopores are regular, short, peripheral. The basal lamella is linear.

Genotype.—*Grammascosoecia* (*Ceriopora*) *dichotoma* Goldfuss, 1827. Maastrichtian.

This genus differs from *Ascosoecia*, in which the tubes are also cylindrical in the presence of short tubes and in the dorsal gemmation on a basal lamella.

It differs from *Reteporidea* D'Orbigny, 1850, in the presence of the short tubes, the dorsal and nonperipheral gemmation and the absence of lamellar structure at the zoarial periphery. It differs from the genus *Parascosoecia* in its cylindrical and nonconical tubes.

In this abundant family, Ascosoeciidae, each genus is clearly characterized either by its system of gemmation or by the form of its tubes, a form which we know corresponds to some special anatomical structure.

GRAMMASCOSOECIA DICHOTOMA Goldfuss, 1827.

1827. *Ceriopora dichotoma* GOLDFUSS, Petrefacta Germaniae, vol. 1, p. 34, pl. 10, fig. 9.

1851. *Heteropora dichotoma* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 47, pl. 5, fig. 75.

1851. *Heteropora undulata* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 47, pl. 5, fig. 16.

1851. *Heteropora tenera* HAGENOW, Die Bryozoen der Maastrichter Kriedebildung, p. 47, pl. 5, fig. 14.

?1894. *Heteropora dichotoma* HENNIG, Studier öfver Bryozoerna i Sveriges Kritsystem II, Cyclostomata, Lunds Universitets Arsskrift, vol. 30, no. 8, p. 22, fig. 12.

?1899. ***Sparsicavea undulata*** Gregory, Catalogue of Cretaceous Bryozoa in British Museum, p. 289, figs. 50, 51 (Bibliography).

1899. ***Sparsicavea dichotoma*** Gregory, Catalogue of Cretaceous Bryozoa in the British Museum, vol. 1, p. 393, vol. 2, p. 304.

1889. ***Heteropora dichotoma*** Pergens, Revision des Bryozoaires du Crétacé figurés par d'Orbigny, Mémoires de la Société Belge de Géologie de Paleontologie et d'Hydrologie, vol. 3. p. 373.

1854. ***Multicrescis laxata***, d'Orbigny, Paleontologie française, Terrain Crétacé, vol. 3, p. 1077, pl. 800, figs. 10, 11 (according to Pergens).

Structure.—The structure of this species has not been comprehended by the various authors who have studied it. The section figured by Hennig is incomplete and does not indicate the basal lamella.

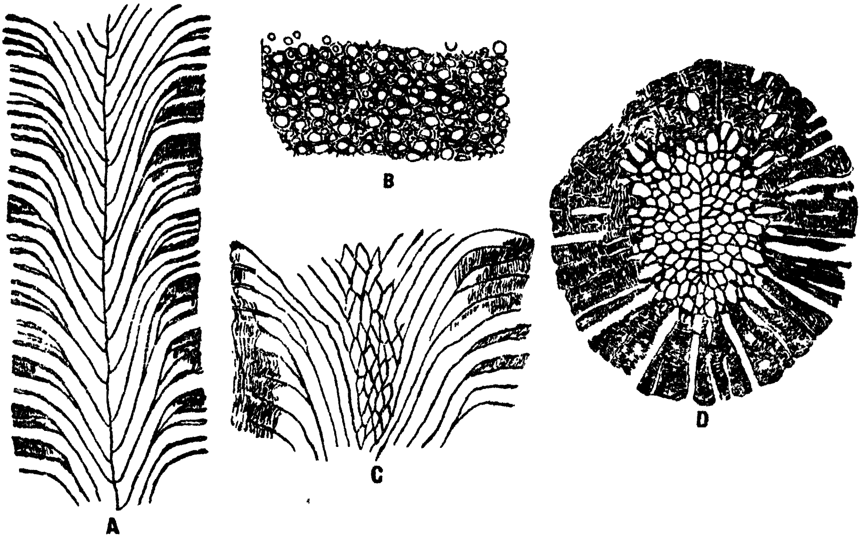


Fig. 35.—Grammascosoecia dichotoma Goldfuss, 1827.

A. Longitudinal section, × 16, showing the basal (median) lamella.
B. Tangential section, × 16.
C. Meridian section, × 16, taken just above the basal lamella.
D. Transverse section, × 16.
Cretaceous (Maastrichtian): Maastricht, Holland.

The transverse section shows in the middle a linear structure always undulated, which represents the remains of the basal lamella. The tubes are polygonal with adjacent walls, perceptibly equal; the inequalities arise from the section which is made perpendicularly to the zoarial axis and not to the tubes.

The longitudinal section should be made perpendicularly to the basal lamella, always visible on the transverse fractures. The tubes are cylindrical, short, supported on the basal lamella according to the method special to all short tubes; at their extremity they are recurved at right angles and their walls are thicker. The mesopores are regular; that is to say, somewhat parallel to the extremity of the tubes; between two peristomes there are generally two, a large and a small one, but the variations and exceptions are quite frequent. They are always formed by ramifications of the proximal tube.

In tangential section the tubes and the mesopores have thick walls. Above each orifice there are always at least two mesopores arranged somewhat transversally and not longitudinally; this arrangement explains the presence of a small and a large mesopore in the longitudinal sections.

The presence of the median basal lamella gives to the zoarium the aspect of a *Mesenteripora* provided with mesopores. The fronds are rarely cylindrical, but are almost always slightly compressed. The meridian section prepared in the immediate vicinity of the basal lamella shows the losenge-shaped areas wider and less geometrical than in the species with club-shaped tubes. They are longer when the section is further removed from the basal lamella.

Affinities.—The three species of Hagenow, *Heteropora tenera*, *dichotoma*, and *undulata*, really form only a single species. Not only are the sections absolutely identical, but all the intermediate stages between these three forms have been found. Gregory, 1909, under the name of *Sparsicavea undulata*, described a species with conical tubes, without basal lamella, which we can not believe is the same as Hagenow's species.

The exterior aspect of these fossils is quite deceiving. For example, *Tretocycloecia dichotoma* Reuss, 1847, has really an analogous aspect, but nevertheless it is not provided with a basal lamella and belongs to a different family. Likewise, the undulated aspect of the zoarium is a character without importance, as may be observed on a large number of species of different families. The section of Hennig, 1894, is incomplete and we are not entirely certain of its determination, since he has not figured the basal lamella. Likewise Pergens, 1889, did not mention it in *Multicrescis laxata* D'Orbigny, 1854.

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland.

Plesiotypes.—Cat. No. 68965, U.S.N.M.

GRAMMASCOSOECIA POROSA, new species.

Plate 21, figs. 9, 10.

Description.—The zoarium is branched or reticulated; the fronds are divergent, irregular, and compressed (elliptical in transverse section). The tubes are cylindrical, short, without peristome, with dorsal gemmation on the basal lamella. The orifices are arranged in irregular quincunx and more or less grouped around the porous elliptical areas formed of a large number of mesopores. The mesopores are small, polygonal, variable in number about each tube. The basal lamella is undulated when it is long and rectilinear when it is very short.

Measurements.—
Diameter of branches............. 5.00 mm.
Diameter of orifices............. 0.10 mm.

Affinities.—We have not discovered the ovicell of this species, and are therefore not able to affirm its classification without doubt, but its structure otherwise is absolutely analogous to that of *Grammascosoecia dichotoma* Goldfuss, 1827. Evidently this reason is not sufficient to classify the two species in the same genus, but it was interesting to discover this same structure in a recent species.

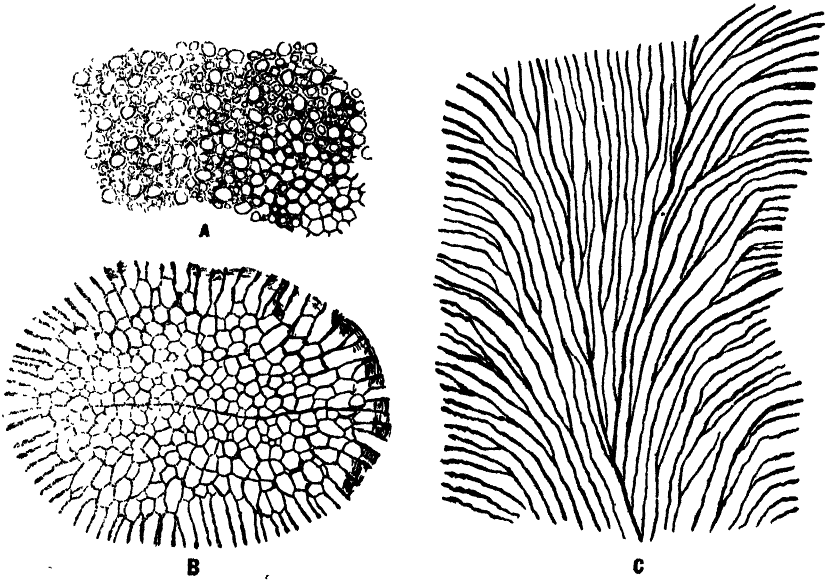


FIG. 36.—Grammascosoecia porosa, new species.
A. Tangential section, × 16.
B. Transverse section, × 16.
C. Longitudinal section, × 16. The basal lamella bifurcates.
Recent: South Africa.

Occurrence.—South Africa. The specimens of this species were some time ago sent to Canu by Miss Jelly.

Cotypes.—Canu collection and Cat. No. 7378, U.S.N.M.

GRAMMASCOSOECIA PARVIPORA, new species.

Plate 21, fig. 7, 8.

Description.—The zoarium is free, cylindrical. The peristomes are small, arranged in regular quincunx, close to each other, thin, salient.

The tubes are cylindrical, recurved at their extremity and separated by the small mesopores irregularly arranged. The ovicell is very large, orbicular, very convex, perforated by a large number of tubes.

Measurements.—	Diameter of peristomes	0.10 mm.
	Distance of peristomes	.42 mm.
	Separation of peristomes	.42 mm.
	Diameter of zoarium	2.00 mm.

Affinities.—This species differs from *Grammascosoecia dichotoma* Goldfuss, 1827, in its smaller micrometric dimensions, in its more salient peristomes, and in a smaller number of mesopores between the peristomes.

In transverse section the basal lamella is very short. The zoarium is surrounded by a thick lamellar tissue, perforated by the mesopores. The intensity of calcification is so great that the mesopores have the aspect of vacuoles in longitudinal sections.

Occurrence.—Cretaceous (Maastrichtian): Maastricht, Holland.

Holotype.—Cat. No. 68967, U.S.N.M.

GRAMMANOTOSOECIA, new genus.

Greek, *gramme*, line, and *notos*, back or dorsal.

Ascosoeciidae with orbicular ovicell. The tubes are long, cylindrical, without peristome, with dorsal gemmation on a basal lamella. There are numerous mesopores between the tubes.

Genotype.—*Grammanotosoecia contorta*, new species. Santonian, Campanian.

In the presence of a median lamella in transverse sections of the free specimens and in the exterior aspect, this genus has much resemblance to *Ditaxia* Hagenow, 1851. It differs from it in the nature of its ovicell, which is like that in the Ascosoeciidae (and not the Liosoeciidae), and in the dorsal gemmation instead of triparietal. It differs from *Grammascosoecia* in its dorsal instead of triparietal gemmation.

GRAMMANOTOSOECIA CONTORTA, new species.

Plate 21, fig. 1–6.

Description.—The zoarium is free and formed of large, narrow, elongated, bilamellar fronds *twisted* around a central axis. The tubes are cylindrical, with dorsal gemmation on a median lamella, without peristome; their orifice is orbicular. The mesopores are numerous, small, polygonal. The ovicell is large and orbicular, perforated by the tubes but not by the mesopores.

Measurements.—	Diameter of orifice	0.10–0.12 mm.
	Diameter of ovicell	1.50 mm.
	Width of fronds	2.00–4.00 mm.

Structure.—The mesopores are distributed irregularly over the zoarial surface. The orifices are similarly distributed, and often their ensemble affects the aspect of *Zonopora.*

The fronds being twisted, it is very difficult to obtain good longitudinal sections. Moreover, our specimens are so highly calcified that we have not been able to make the sections thin enough for good photography. Nevertheless we have been able to verify that the tubes were cylindrical and that the gemmation was dorsal. The median lamella is thin and fragile.

In transverse section the tubes everywhere have the same diameter, showing that they are cylindrical. The small tubes adjacent to the median line being much smaller, reveal the dorsal gemmation. The median lamella is very thin and rectilinear.

Occurrence.—Cretaceous (Santonian): St. Bonnier and Deviat (Charente), France.

Cretaceous (Campanian): Gaineau, Brossac, Montmoreau, Maud, Saint Médard, Saint Aulais and Salles (Charente), France.

Cotypes.—Canu collection and Cat. No. 68968, U.S.N.M.

Genus POLYASCOSOECIA Canu and Bassler, 1920.

1920. *Polyascosoecia* Canu and Bassler, North American Early Tertiary Bryozoa, Bull. 106 U. S. National Museum, p. 837.

The ovicell is globular, salient, spread between the fascicles whose length it augments, placed eccentrically on the frontal. The tubes are cylindrical, oriented, short, with triparietal gemmation; they ramify into numerous mesopores or vacuoles on the frontal. The dorsal of the zoarium is thick, with lamellar structure, and perforated by vacuoles bent toward the base.

Genotype.—*Polyascosoecia coronopus*, new species.

Range.—Jacksonian-Plaisancian.

This genus differs from *Pleuronea*, in which the ovicell is placed identically, not only in the different nature of the ovicell, but in its cylindrical tubes. It differs from the genus *Erkosonea*, equally provided with pores on the two faces of the zoarium, in its ovicell placed laterally, and in its short cylindrical tubes, with triparietal gemmation.

The known species belonging to this genus are as follows:

Polyascosoecia coronopus, new species. Helvetian.
Polyascosoecia jacksonica Canu and Bassler. Jacksonian.
Polyascosoecia imbricata Canu and Bassler. Jacksonian.
Polyascosoecia (*Hornera*) *sparsa* Reuss, 1864. Latdorfian.
Polyascosoecia (*Crisina*) *foraminosa* Reuss, 1865. Rupelian (Stampian).
Polyascosoecia (*Crisina*) *canaliculata* Reuss, 1865. Rupelian (Stampian).

Polyascosoecia (*Idmonea*) *foraminosa* Manzoni, 1877. Miocene.

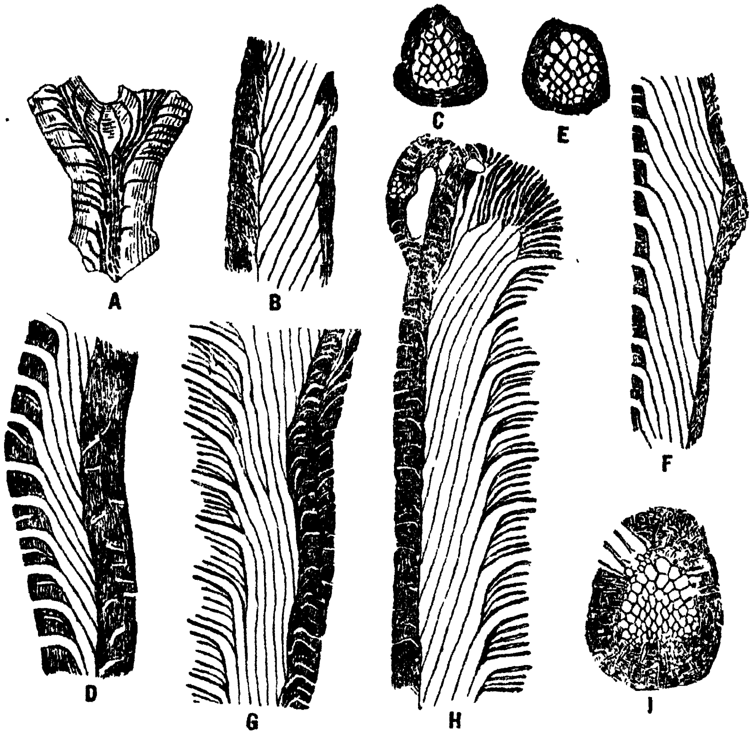


FIG. 37.—Genus Polyascosoecia Canu and Bassler, 1920.

A–D. *Polyascosoecia lichenoides* Goldfuss, 1827.

A. Longitudinal section, × 12, showing the zooecia perforating the thick lamellar structure (after Gregory).

B. Longitudinal section, × 16.

C. Transverse section, × 16.

D. Another longitudinal section, × 16.

Cretaceous (Maastrichtian): Maastricht, Holland.

E, F. *Polyascosoecia cancellata* Goldfuss, 1829.

Transverse and longitudinal sections, × 16.

Cretaceous (Maastrichtian): Maastricht, Holland.

G–I. *Polyascosoecia coronopus*, new species.

G. Longitudinal section, ×16, of a zoarium with a second dorsal layer.

H. Longitudinal section, × 16, showing the zooecia and mesopores to the right and the lamellar tissue pierced with vacuoles to the left.

I. Transverse section, × 16.

Miocene (Helvetian): Mus (Gard), France.

Polyascosoecia (*Idmonea*) *cancellata* Reuss, 1847 (not Goldfuss). Miocene.

Polyascosoecia (*Idmonea*) *punctata* Busk, 1859. Plaisancian.

Polyascosoecia (*Idmonea*) *lichenoides* Goldfuss, 1847. Maastrichtian.

Polyascosoecia (*Idmonea*) *cancellata* Goldfuss, 1827. Campanian (Danian).

The last two species, in which the frontal mesopores are replaced by vacuoles, will probably be referred to another genus when the ovicells are better known.

POLYASCOSOECIA CORONOPUS, new species.

Plate 20, fig. 1–8.

Description.—The zoarium is idmoneiform, borne on an expanded base attached to marine objects; the branches are ramified dichotomously like the horn of a deer. The linear fascicles are little salient, formed of 5–6 tubes; they are opposite with respect to the median axis of the zoarium and somewhat distant from the latter. The tubes are cylindrical and oriented (longitudinal section). There are mesopores on the anterior face and vacuoles on the posterior face. The ovicell is a large salient sack placed to the right or left of the median axis between three fascicles:

Measurements.—	Width of fascicles	0.10 mm.
	Separation of fascicles	.24 mm.
	Diameter of tubes (in section)	.12 mm.
	Diameter of basal trunk	1.50 mm.
	Diameter of branches	1.00 mm.

Structure.—The general aspect is that of an *Idmonea* entirely covered with pores on all sides of the zoarium; but the study of thin sections indicates that these pores have not the same structure nor the same function.

In transverse section all the tubes have not the same diameter, and we can only surmise that the tubes are club shaped. The longitudinal section indicates short cylindrical tubes. This discordance arises from the fact that this section has been made perpendicularly to the zoarial axis and not to the direction of the tubes. A transverse section with unequal tubes crossing from the center to the circumference can therefore reveal, in the Idmoneoid forms, likewise some long, club-shaped tubes as well as short, cylindrical tubes. The necessity of longitudinal sections is therefore absolute.

In longitudinal section the cylindrical tubes are oriented on the same side of the basal lamella; they grow on the dorsal, one from the other according to the ordinary rule of oriented zooecia. At their extremity they branch into three or four mesopores very regular in their length and their direction. The dorsal is very thick and formed by lamellar tissue similar to that in the Horneridae; it is perforated by vacuoles. These small tubes appear to grow one from the other on the other side of the basal lamella; they are bent at right angles and are terminated obliquely and directed toward the base. We are unable to say if they were completely independent of the adjacent tubes or if they were formed from the divergent branches. We believe more in their independence, for the cylindrical tubes multiply by successive bifurcation, which is not the case. Moreover, the dorsal may be formed by two lamellae of vacuoles. The presence of a polypide is therefore not necessary to the life of the accessory tubes.

The base of the zoarium is expanded. Unfortunately we have not been able to make a section and we are ignorant of its mode of formation.

The ovicell slightly resembles *Pleuronea;* but in the family Tubuliporidae the tubes surrounded by the ovicell never modify their length. On the contrary, in the family Ascosoeciidae the peristomes of the tubes surrounded by the ovicell are much elongated, so that they are either isolated (*Ascosoecia*) or, as here, they are fasciculated. These tubes are always open, but they may be closed by fossilization or by accident.

Affinities.—The Cretaceous species figured by Goldfuss have a reticulate zoarium, and we have no knowledge of its internal structure. In this connection we may observe that species having a similar aspect may have absolutely different relationships.

Retepora lichenoides Goldfuss, 1827, which Gregory classed as *Retecava*, is a Cretaceous species quite similar not only in its exterior aspect but also in the presence of dorsal vacuoles, but it differs from the present form in the presence of frontal mesopores (and not vacuoles).

Crisina foraminosa Reuss, 1851, and *Crisina canaliculata* Reuss, 1866, have the same exterior aspect, but we have no knowledge of its structure in these sections. Our species appears to differ in its more salient fascicles.

Occurrence.—Miocene (Burdigalian): La Combe near Mus (Gard), Sauveterre (Hérault), Les Angles (Gard), France.

Miocene (Helvetian): Loupian and Montagnac (Herault) and La Combe near Mus (Gard), France.

Cotypes.—Canu collection and Cat. No. 68969, U.S.N.M.

POLYASCOSOECIA LICHENOIDES Goldfuss, 1827.

1827. *Retepora lichenoides* GOLDFUSS, Petrefacta Germaniae, p. 29, pl. 9, fig. 13.

1851. *Idmonea lichenoides* HAGENOW, Die Bryozoen der Maastrichten Kreidebildung, p. 28, pl. 2, fig. 6.

1851. *Coelophyma granulatum* HAGENOW, Die Bryozoen der Maastrichten Kreidebildung, p. 106, pl. 2, fig. 17.

1899. *Retecava lichenoides* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, p. 194, fig. 16.

Sections of this species are difficult to make on account of the irregularity of its branches. We illustrate the best of our sections; and although they are not perfect, the real structure is shown.

The tubes are cylindrical, short, with triparietal gemmation, without peristome; their extremity is quite thick, forming a calcareous dilation perforated by a vacuole. The dorsal is very thick, of lamellar structure, and perforated by vacuoles.

The ovicell was long ago illustrated by Hagenow, but unfortunately has not been found again. We are therefore ignorant as to whether his figure is entirely exact. His drawing is too small and the tubes are not visible. Nevertheless, the place of the ovicell, its form, and the similarity of the sections cause us to place this species in *Polyascosoecia.*

The section given by Gregory is a meridian section; it confirms us in the nature of the adventitious pores, which are clearly vacuoles.

Geological distribution.—Cretaceous (Campanian): Rügen, Germany.

Cretaceous (Maastrichtian): Maastricht, Falkenberg, and Petit Lanage (Limbourg), Holland.

Plesiotypes.—Canu collection and Cat. No. 68970, U.S.N.M.

POLYASCOSOECIA CANCELLATA Goldfuss, 1829.

1829. *Retepora cancellata* GOLDFUSS, Petrefacta Germaniae, vol. 1, p. 103, pl. 36, fig. 17.

1851. *Idmonea cancellata* HAGENOW, Bryozoen der Maastrichter Kreidebildung, p. 29, pl. 2, fig. 7.

1899. *Retecava concellata* GREGORY, Catalogue of the fossil Bryozoa in the British Museum. Cretaceous, vol. 1, p. 202 (Bibliography).

1894. *Idmonea cancellata* HENNIG, Studien öfver Bryozoerna I Sveriges Kritsystem, II, Lunds Universitets Arssdrift, vol. 30, no. 8, p. 10, pl. 1, figs. 4–6.

Structure.—Thin sections are very difficult to interpret in species with a thick lamellar structure. Nevertheless by combining all the different sections we can comprehend the real structure of the present species.

In longitudinal section the tubes are cylindrical with triparietal gemmation. A very thick lamellar tissue entirely surrounds the zoarium; it is perforated by the vacuoles. This structure is absolutely identical with that of *Polyascosoecia lichenoides* Goldfuss, 1829, and of *P. coronopus*, the genotype. Although we have not discovered its ovicell, we do not hesitate to class this species in the genus *Polyascosoecia.*

Geologic distribution.—Cretaceous (Campanian); Rügen, Germany (Hagenow, Marsson).

Cretaceous (Maastrichtian); Maastricht, Petit-Lanage, Fauquemont (Limbourg), Holland (Hagenow), Royan (Charente-inferieure), France (D'Orbigny).

Cretaceous (Danian); Faxe and D'Annetorp, Denmark (Hennig), *Plesiotypes.*—Canu collection and Cat. No. 68971, U.S.N.M.

Genus RETEPORIDEA D'Orbigny, 1852.

1852. *Reteporidea* D'ORBIGNY, Paléontologie Française, Terrain Crétacé, vol. 5.

The ovicell is a large inflation, quite convex, covering the entire width of the zoarium. The tubes are cylindrical, with peristome and with axial gemmation by bifurcation at all heights. There are divergent parietal mesopores on the anterior face and vacuoles buried in a lamellar tissue on the posterior face.

Genotype.—*Reteporidea royana* D'Orbigny, 1850. Cretaceous.

Historical.—Gregory in 1899 suppressed this genus of D'Orbigny because he identified it with *Semicellaria* and *Laterocavea* of the same author and because he had adopted the genus *Hemicellaria* D'Orbigny, 1847, which D'Orbigny had later declared to be erroneous. We could adopt the conclusions of Gregory only after the discovery of the ovicell of *Semicellaria* and *Laterocavea* and the preparation of the necessary sections.

Our studies having been based on typical specimens of *Reteporidea*, we are obliged to recognize D'Orbigny's genus in its original meaning.

Affinities.—This genus differs from *Ascosoecia* in the presence of vacuoles and in the great thickness of lamellar tissue over all the zoarium. It differs from *Parascosoecia* in its cylindrical and non-conical tubes.

RETEPORIDEA ROYANA D'Orbigny, 1854.

Plate 22, figs. 1–5.

1854. *Reteporidea royana* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, Bryozoaires, p. 937, pl. 608, figs. 1–5; pl. 772, figs. 17, 18.
1899. *Hemicellaria royana* GREGORY, Catalogue Fossil Bryozoa in British Museum, Cretaceous, p. 369 (Bibliography).

Measurements.—	Peristome	0.12 mm.
	Distance between peristomes	.36 mm.
	Separation of peristomes in quincunx	.36 mm.
	Diameter of branches	.80 mm.
	Dimension of the fenestrae	1.00 by 0.70–.80 mm.

Structure.—D'Orbigny's figures are absolutely exact. The tubes are arranged on the anterior face of the branches which is at the same time the exterior face of the zoarium. The latter assumes the form of a deep, conical cup whose interior was occupied by the noncellular face of the branches. The zoaria may attain the size of the hand. We have frequently found the ovicells broken.

In longitudinal section the tubes are cylindrical with peristome; they are oriented toward the exterior, but they branch at all heights, as in the zoarial form *Frondipora.* There is no basal lamella. The zoarial walls are very thick, and are formed of a much developed and very irregular lamellar tissue; the lamellae are separable.

The mesopores of the exterior face are divergent; they are not exactly parallel to the recurved extremity of the tubes; their section is therefore complex and has not the regularity of *Sparsicavea.* Moreover, the zoarial lamellae complicate even more the general aspect.

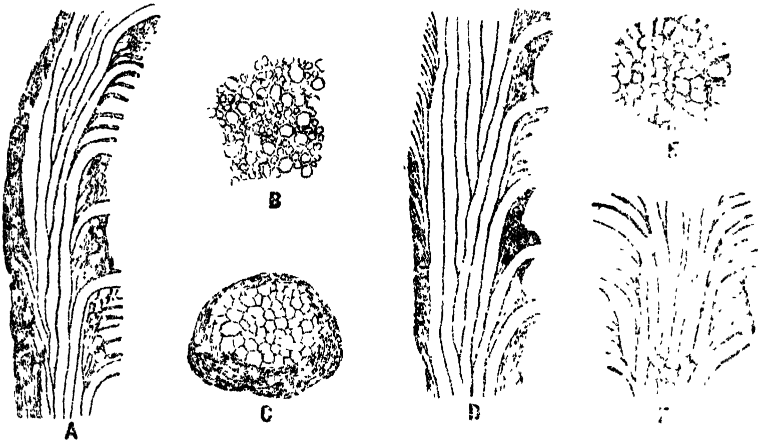


FIG. 38.—Genus Reteporidea D'Orbigny, 1852.

A–C. *Reteporidea royana* D'Orbigny, 1852.

A. Longitudinal section, × 16, illustrating the mesopores to the right and the vacuoles to the left.

B. Tangential section, × 16.

C. Transverse section, × 16.

Cretaceous (Maastrichtian): Royan, France.

D–F. *Reteporidea ramosa* D'Orbigny, 1854.

D. Longitudinal section, × 16, showing the vacuoles clearly.

E. Transverse section, × 16.

F. Meridian section, × 16, showing the structure of the mesopores.

Cretaceous (Maastrichtian): Royan, France.

On the dorsal the lamellar tissue is quite compact and it is difficult to see the nature of the dorsal pores which appear as vacuoles if the preparation is not thin enough.

In transverse section the zoarial walls appear also very thick and lamellar. The tubes are polygonal.

In the tangential section we observe some very small mesopores disseminated in small numbers between the tubes. This is not the exterior aspect, for the mesopores are quite expanded at their terminal extremity.

Affinities.—The peristomes are salient and thin. The mesopores are much expanded, irregularly arranged around the peristomes. On the dorsal the vacuoles are also much expanded in their terminal portion; they are arranged in rather regular quincunx. The transverse rows of peristomes are not fasciculated and the peristomes arranged in quincunx are not rare.

The fenestrae of the zoarium are always less wide than the branches; the species differs from *Reteporidea collardeti* in this character.

Occurrence.—Cretaceous (Maastrichtian): Royan and St. Legér (Charente inférieure), Ste. Colombe (Manche), (D'Orbigny), Talmont, and Bessac, France.

The specimens from Meudon, near Paris, noted by D'Orbigny as belonging to this species appear to us on the contrary to form a distinct species (*R. collardeti*).

Plesiotypes.—Canu collection and Cat. No. 68972. U.S.N.M.

RETEPORIDEA RAMOSA D'Orbigny, 1854.

1854. *Reteporidea ramosa* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, Bryozoaires, p. 938, pl. 608, figs. 6–10; pl. 773, figs. 1–3.

1889. *Hornera ramosa* PERGENS, Revision des Bryozoaires du Crétacé, figurés par d'Orbigny, Memoires de la Société Belge de Géologie, etc., vol. 3, p. 353.

1890. *Hemicellaria ramosa* GREGORY, Catalogue of Fossil Bryozoa in British Museum, Cretaceous, p. 371.

Measurements.—	Diameter of peristome	0.12–0.14 mm.
	Distance between peristomes	.30 mm.
	Separation of peristomes	.36 mm.
	Diameter of branches	1.40 mm.

Structure.—The zoarium is not reticulated, but it offers the same peculiarities as that of *Reteporidea royana* D'Orbigny, 1850. It is large, conical; its base is discoidal and little expanded. The cellular face is exterior; the noncellular face is interior. The zoarium does not therefore constitute a trap for diatoms. The walls are very thick and are formed of lamellar tissue.

In longitudinal section the tubes are cylindrical, oriented toward the exterior, with gemmation by bifurcation at all heights (peripheral). There is no basal lamella.

The mesopores are divergent, not parallel to the recurved extremity of the tubes; buried in the lamellar tissue, they are little apparent. They are much widened in their terminal portion.

The vacuoles are capillary, numerous, adjacent, and perforate a very thick lamellar tissue. These are the ramifications of the dorsal tubes. However, the direct ramifications are visible at the exterior through an orifice which is a little larger, surrounded by a very short peristome; the secondary ramifications constitute the other visible orifices. This character is quite clear in our figure.

In transverse section the tubes are all equal, polygonal, and surrounded by a thick lamellar tissue.

Affinities.—The peristomes are often more or less grouped in transverse interrupted rows, but they never form fascicles. On certain portions of the zoarium they are even arranged in quincunx, and we have been able to measure their separation.

The specimens from Meudon mentioned by D'Orbigny appear to form a distinct species, *Reteporidea subramosa*, in which the peristomes are always arranged in quincunx and the branches are more divergent.

On the posterior face (interior) there are true sulci (characteristic of lamellar tissue), at the base of which are the openings of the vacuoles.

Occurrence.—Cretaceous (Maastrichtian): Royan and Bougniaux (Charente inferieure) and Ste. Colombe (Manche) (D'Orbigny); Courgeac, Poulipiac (LeGabriel) and Manie Roux (Dordogne). France.

Plesiotypes.—Canu collection and Cat. No. 68972, U.S.N.M.

RETEPORIDEA COLLARDETI, new species.

Plate 22, figs. 10-15.

Description.—The zoarium is reticulate, with wide meshes, in which the fenestrae are always wider than the branches. The branches are thin, orbicular. The tubes are arranged in transverse, irregular and interrupted rows; the peristome is thin and salient. The mesopores are numerous, hexagonal, funnel shaped. On the dorsal the vacuoles are small and arranged at the base of the very fine longitudinal sulci. The ovicell is enormous, globular salient, elliptical; it occupies the entire width of the branch; it is perforated by peristomes much separated and occasionally closed.

Measurements.—	Diameter of peristome	0.12 mm.
	Diameter of branches	.80 mm.
	Dimensions of fenestrae	2.00 by 0.90 mm.

Affinities.—D'Orbigny has confused this species with his *Reteporidea royana;* the two species are, in fact, quite similar in their aspect and in their micrometric measurements. The present species differs solely in its zoarial aspect with wide meshes, the fenestrae being always wider than the branches.

This species is dedicated to General Louis Collardet, military attaché to the French Embassy in Washington, District of Columbia, who was a brave soldier, an able diplomat, and a courteous gentleman, and whose charming nature made for him many friends in the United States.

Occurrence.—Cretaceous (Campanian): Meudon, near Paris, France.

Cotypes.—Canu collection and Cat. No. 68973, U.S.N.M.

RETEPORIDEA SUBRAMOSA, new species.

Plate 22, figs. 6–9.

Description.—The zoarium is free, branched; the branches are orbicular, dichotomous, and divergent. The tubes are arranged on the exterior face; the peristomes are little salient, thin, and arranged in regular quincunx. The mesopores are numerous, hexagonal, funnel shaped. On the dorsal the vacuoles are hexagonal, arranged in quincunx.

Measurements.—

Measurements.—	Diameter of peristome	0.12 mm.
	Distance between peristomes	.50 mm.
	Separation of peristomes	.40 mm.
	Diameter of branches	1.50 mm.

Affinities.—This species is quite similar to *Reteporidea ramosa* D'Orbigny, 1850, but differs in its much more divergent branches, and in its tubes arranged always in quincunx and more scattered.

Occurrence.—Cretaceous (Campanian): Meudon, near Paris, France.

Cotypes.—Canu Collection and Cat. No. 68974, U.S.N.M.

Genus SULCOCAVA D'Orbigny, 1854.

1854. *Sulcocava* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1021.

The ovicell is a globular sack surrounding many rows of peristomes. It is placed on the sharp edge of the zoarium and spread out over half of the broad face. The tubes are funnel shaped, with peristome long, with dorsal gemmation, ramified at all heights of the zoarial axis, recurved at their extremity. A very thick lamellar epitheca surrounds the zoarium and consolidates the peristomes. The orifice is narrow and smaller than the tube. The zoarium is covered by longitudinal sulci.

Genotype.—*Sulcocava cristata* D'Orbigny, 1851.

Range.—Coniacian-Maastrichtian.

Affinities.—This genus differs from *Parascosoecia* in the absence of mesopores. Gregory classed the genus in the Idmoneidae, but the peristomes are not grouped in true fascicles, as in the true *Idmonea*, and the ovicells are quite different.

SULCOCAVA CRISTATA D'Orbigny, 1854.

Plate 19, figs. 13–18.

1853–54. *Sulcocava cristata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1021, pl. 789, figs. 4–8.

1853–54. *Sulcocava sulcata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1020, pl. 789, figs. 1–3.

1853–54. *Sulcocava sulcata* D'ORBIGNY, Paléontologie française, Terrain Crétacé, vol. 5, p. 1022, pl. 789, figs. 9–12.

1899. *Sulcocava cristata* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 211 (Bibliography only, not figs. 21, 22).

1899. *Sulcocava sulcata* GREGORY, Catalogue of the Cretaceous Bryozoa in the British Museum, vol. 1, p. 215 (Bibliography).

Structure.—The peristomes are arranged in transverse and alternate rows on the zoarium, but they are never adjacent and do not form fascicles. The longitudinal furrows are quite regular, but they are easily attenuated by weathering or fossilization; the general aspect is quite variable.

The transverse section is generally lozenge-shaped. It is necessary to prepare the meridian section parallel to the longer axis and the longitudinal section to the shorter axis. The zoarium is surrounded by a sort of lamellar epitheca. The tubes are quite small at the center.

The longitudinal section is quite interesting and complicated. The tubes are funnel-shaped (=club-shaped); they are shorter than in *Entalophora*; their gemmation is dorsal and occurs in the immediate vicinity of the zoarial axis. The small interzooecial space is large enough to be easily visible in all the sections; it opens at the exterior by two small pores visible above and below each aperture. Finally very thick lamellar tissue surounds the zoarium and partially fills the interzooecial space; it consolidates the recurved portion of the tubes, but is independent of the latter. Sometimes it is perforated by a vacuole.

The lamellar tissue often narrows the aperture and also the peristome, which thus becomes totally or partially invisible in sections. The exterior lamella is less dense than the interior lamellae.

The meridian section shows the tubes with successive constrictions. This feature is due to the arrangement of the tubes in transverse rows and to the compression of the zoarium in a determined direction. There is no basal lamella, and this arrangement of the tubes does not form lozenge-shaped networks.

The ovicells are extremely rare; we have not been able to dissect a single one of them, so that the position of the genus in the family Ascosoeciidae is not exactly certain; the exterior appearance might be deceiving.

Historical.—It is quite true that *Sulcococava sulcata* D'Orbigny 1854, must be identical with *Sulcocava cristata*, as Pergens thought in 1889. Gregory's bibliography of 1909 is good, but his determination of specimens from Chatham is incorrect and his figures represent an absolutely distinct species, *Sulcocava depressa.*

Occurrence.—Cretaceous (Coniacian): Tours (Indre-et-Loire), Villedieu (Loir-et-Cher), Fécamp (Seine inferieure), France.

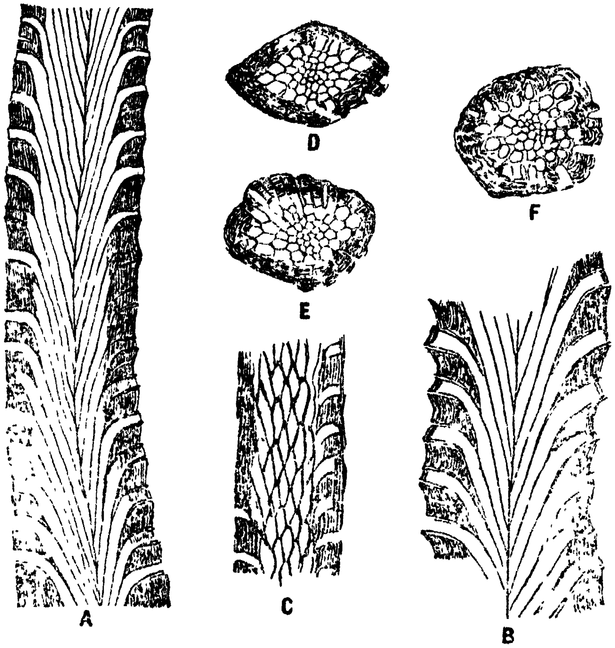


FIG. 39.—Sulcocava cristata D'Orbigny, 1854.

A, B. Longitudinal section, × 16, the second showing the hollow walls of the tubes.

C. Meridian section, × 16.

D–F. Three transverse sections, × 16, the first illustrating the normal shape of the zoarium.

Cretaceous (Coniacian): Tours, France.

Cretaceous (Santonian): Vendôme (Loir-et-Cher) and St. Paterne (Indre-et-Loire), France.

Plesiotypes.—Canu collection and Cat. No. 68975, U.S.N.M.

Genus CAVARINELLA Marsson, 1887.

1887. *Cavarinella* MARSSON, Die Bryozoen der Maastrichter Kreidebildung, p. 53.

CAVARINELLA RAMOSA Marsson, 1887.

Plate 19, fig. 10.

?1851. *Cavaria ramosa* HAGENOW, Die Bryozoen der Maastrichter Kreidebildung, p. 53, pl. 6, fig. 1.

1887. *Cavarinella ramosa* MARSSON, Die Bryozoen der weissen Schreibkreide der Insel Rügen, Paleontologische Abhundlungen, vol. 4, p. 19, pl. 1, fig. 6.

Our ovicelled specimen resembles Marsson's figure, but we are not certain that Hagenow's species is identical with it. The lack of specimens has not permitted us to make thin sections and to verify the exact nature of the genus *Cavarinella*, but it appears to differ from *Parascosoecia* only in its hollow zoarium, a character without great importance.

Cavaria Hagenow, 1871, as originally held, is only a zoarial form for this author classified here all the arborescent species with hollow zoaria. Marsson, 1887, chose for the type *Cavaria pustulosa* Hagenow, 1870, a species without mesopores. Gregory, 1899, undid the work of Marsson and chose for the type *Cavaria ramosa* Hagenow, 1851, which Marsson in 1887 had selected as the type of his genus *Cavarinella*. Examination of the figures and sections does not show the identity of the two species, so we have adopted provisionally Marsson's genus and on a former page have discussed the genus *Cavaria*.

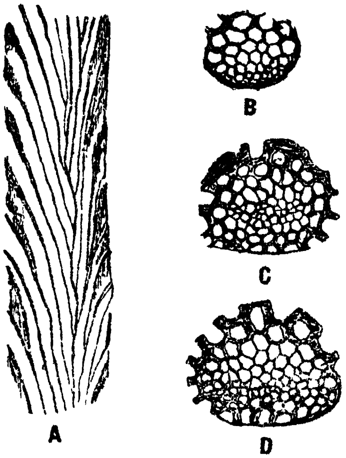


Fig. 40.—*Filicrisina verticillata* D'Orbigny, 1852.

A. Longitudinal section, × 16, illustrating the dactylethrae of the dorsal.
B–D. Three transverse sections, × 16.
Cretaceous (Campanian): Longuesse, France.

Occurrence.—Cretaceous (Danian): Herfolge (Seeland), Denmark.

Geologic distribution.—Cretaceous (Campanian): Island of Rügen, Germany; Cretaceous (Maastrichtian): Maastricht, Holland.

Plesiotype.—Cat. No. 68976, U.S.N.M.

Genus FILICRISINA D'Orbigny, 1852.

1852. *Filicrisina* D'Orbigny, Paléontologie française, Terrain Crétacé, vol. 5, p. 910.

1887. *Phormopora* Marsson, Bryozoen der schreibkreide der Insel Rügen, Paleontologische Abhandlungen, vol. 4, p. 32.

Ascosoeciidae in which the ovicell is placed laterally. The tubes are conical, with peristome and with dorsal gemmation. They are placed on the anterior face and arranged in more or less transverse rows. Dactylethrae are developed on the posterior face; they are closed by a lozenge-shaped facette, perforated by a longitudinal slit.

Genotype.—*Filicrisina verticillata* D'Orbigny, 1852. Campanian. The known species of this genus are *Filicrisina retiformis* D'Orbigny, 1852; *Hornera langethali* Marsson, 1887; *Phormopora irregularis* Marsson, 1887; and *Spiroclausa procera* Hamm.

Historical.—D'Orbigny classified this genus in the family Crisinidae, characterized by the presence of pores on the opposite face. Marsson, 1887, created the genus *Phormopora* for an analogous species, but a comparison of thin sections shows that its structure is similar to *Filicrisina*. Gregory in 1899 classified *Filiscrisina* in the Diastoporidae, close to *Filisparsa*, from which it differed in the rudimentary zooecia. He designated their orifices as small pores of epithecal tubes, which is not at all correct, because there are neither tubules nor vacuoles. He chose as type *Filicrisina retiformis*, but we have not studied this species in detail.

FILICRISINA VERTICILLATA D'Orbigny, 1852.

Plate 19, figs. 1–9.

1852. *Filicrisina verticillata* D'ORBIGNY, Paleontologie francaise, Terrain crétacé, vol. 5, p. 911, pl. 769, figs. 5–10.

1899. *Filicrisina verticillata* GREGORY, Catalogue of Bryozoa in British Museum, Cretaceous, vol. 1, p. 434, fig. 64 (bibliography).

The figured ovicells appears to us rudimentary, and better specimens are desirable. Under this aspect the ovicell is identical with the sack of the Ascosoeciidae.

The dorsal (reverse side of Gregory) is very curious. It is ornamented with lozenge-shaped areas bounded by salient threads, the superior angle of which is perforated by a longitudinal slit with salient peristome. A second calcareous layer covers this side, in which case the lozenge-shaped areas are smaller or poorly indicated and the small pores are rounded.

On the frontal (obverse side of Gregory) the peristomes are arranged in transverse, oblique rows or more rarely in quincunx.

The longitudinal section indicates the true nature of these exterior features. The tubes are conical, with dorsal gemmation and identical in structure with those of *Filisparsa*, *Entalophora*, *Idmonea*, etc., but they are aborted on the dorsal face and transformed into dactylethrae. The lozenge-shaped areas of the dorsal are therefore the facettes which close the dactylethrae, and there are therefore no epithecal tubules, as described by Gregory in 1899.

The transverse section is that of *Entalophora*, but eccentrically arranged, for it is impossible to distinguish the tubes of the dactylethrae. There is no basal lamella, and gemmation occurs around the zoarial axis. The latter, with the reduction of the dactylethrae is eccentric with relation to the geometrical center.

Occurrence.—Cretaceous (Campanian): Longuesse (Seine et Oise), France.

Plesiotypes.—Canu collection and Cat. No. 68977, U.S.N.M.

EXPLANATION OF PLATES.

PLATE 1.

FIG. 1. *Oncousoecia (Filisparsa) bifurcata* Ulrich and Bassler, 1907 ---- page 6.
Fragment of branch, × 12, preserving an ovicell. The oeciostome is transverse and wide.
Cretaceous (Vincentown marl): Vincentown, New Jersey.

FIGS. 2–5. *Oncousoecia accumulata*, new species ---- page 6.
2. Three zoaria, natural size.
3. A complete example, × 3, formed of discoid subcolonies piled upon each other.
4. A portion of the same, × 12, illustrating the position of the ovicell on the margin of each subcolony.
5. The extremity of a branch, × 12, illustrating the young portion of the subcolony.

Jurassic rocks of Germany.

FIGS. 6–8. *Mecynoecia obesa*, new species ---- page 12.
6. Two fragments, natural size.
7. An ovicelled branch, × 12.
8 Another example, × 12.

Recent: Philippine Islands, Sulade (*Albatross* Station D 5147).

FIGS. 9–11. *Mecynoecia longipora*, MacGillivray, 1895 ---- page 13.
9. Zoarial fragments, natural size.
10. A branch, × 12, with the ovicell near the bifurcation and showing the prominent transverse oeciostome.
11. Another ovicelled fragment, × 12, with the ovicell at the bifurcation of the branches and showing wrinkling of the tubes.

Recent: Philippine Islands. Anima Sola (*Albatross* Station D 5217).

FIGS. 12, 13. *Mecynoecia ramosissima* D'Orbigny, 1850 ---- page 14.
12. A bifurcated branch, × 6, with nonverticellate tubes and two ovicells developed.
13 A portion of an ovicelled branch, × 12, showing the transverse, elliptical oeciostome and the tubes arranged in verticells.

Cretaceous (Cenomanian): Le Mans (Sarthe), France.

FIGS. 14, 15. *Mecynoecia stipata*, new species ---- page 15.
14. A nonovicelled branch, × 6, illustrating the close arrangement of the tubes.
15. A branch, × 12, showing a broken ovicell at the base and an abnormal one with a median furrow, higher up.

Cretaceous (Turonian): Ruillé Poncé (Loir-et-Cher), France.

FIGS. 16, 17. *Mecynoecia (Spiropora) verticillata* Goldfuss, 1827 ---- page 13.
16. An unovicelled branch, × 12.
17. An ovicelled example, × 12, showing that the ovicell covers three verticells of tubes.

Cretaceous (Maastrichtian): Maastricht, Holland.

FIG 18. *Notoplagioecia farringdonensis*, new species ---- page 30.
Portion of a compressed branch, × 12, with a broken ovicell.
Lower Cretaceous (Aptian): Farringdon, England.

PLATE 2.

FIG. 1. *Mecynoecia micropora* D'Orbigny, 1853 .... page 16.
An ovicelled example, × 12.
Cretaceous (Coniacian): Tours (Indre-et-Loir), France.

FIGS. 2–10. *Mecynoecia annulosa* Michelin, 1847 .... page 16.
2. Several fragments, natural size.
3. A bifurcated fragment, × 12, with an elongated sacciform ovicell showing a transverse oeciostome.
4. Fragment, × 12, in which the ovicell is cordiform.
5. Another example, × 12, with a pyriform ovicell.
6. A branch, × 12, with the ovicell placed among verticellate tubes.
7. A branch, × 6, with the tubes arranged in quincunx at the base and in verticells at the top.
8. A verticellate specimen, × 6, with small orifices.
9. An example, × 6, with large orifices.
Jurassic (Bathonian): Occaignes (Orne), France.
10. An ovicelled specimen, × 12, in which the oeciostome is supported by an ordinary peristome.
Jurassic (Bathonian): Ranville (Calvados), France.

FIG. 11. *Microecia denisi*, new species .... page 21.
The ovicelled type specimen, × 12, exhibiting the minute oeciostome.
Cretaceous (Turonian): Ruillé Poncé (Loire-et-Cher), France.

FIGS 12, 13. *Trigonoecia michelini* Blainville, 1830 .... page 18.
12. A specimen, × 12, preserving two forms of ovicells.
13. Another example with two triangular ovicells, × 12.
Jurassic (Bathonian): Ranville (Calvados), France.

FIG. 14. *Mecynoecia variabilis* Hagenow, 1851 .... page 16.
An ovicelled specimen, × 12, with the upper end of the ovicell missing.
Cretaceous (Maastrichtian): Maastricht, Holland.

PLATE 3.

FIGS. 1–5. *Brachysoecia convexa*, new species .... page 22.
1. Cylindrical branching fragment, natural size.
2. Portion of same, × 12, showing the ovicell and the zone of growth.
3. View of the ovicell, × 25. The ovicell is short and the oeciostome is reflexed and adjacent to the peristome.
4. Ordinary zooecia, × 25, in which some of the apertures are closed by a diaphragm.
5. A tangential thin section, × 25.
Cretaceous (Cenomanian): Le Mans (Sarthe) France.

FIG. 6. *Bisidmonea tetragona* Lamouroux 1821 .... page 24.
6. A fragment, × 12, bearing the ovicell.
Jurassic (Bathonian): Ranville (Calvados), France.

FIGS. 7–10. *Bisidmonea? globuloecia*, new species .... page 25.
7, 8. Fragment, natural size, and × 12, of this minute species.
9. The ovicelled side, × 12.
10. Portion of branch, × 25.
Cretaceous (Cenomanian): Montlouet (Maine-et-Loire), France.

FIG. 11. *Plagioecia clypeiformis* D'Orbigny, 1853 .... page 28.
11. Entire zoarium, × 12, bearing two ovicells.
Cretaceous (Turonian): Fontaine d'Antoigne, near Chatellerault (Vienne), France.

FIG. 12. *Plagioecia varians* Ulrich, 1901 .... page 26.
An ovicelled zoarium, × 12, consisting of a single subcoloney.
Cretaceous (Vincentown marl) : Vincentown, New Jersey.

FIGS. 13–15. *Plagioecia americana* Ulrich and Bassler, 1907 .... page 27.
13. An ovicelled example, × 12, in which the ovicell is short and shows the oeciostome clearly turned toward the base.
14. Another ovicelled example, × 12, exhibiting longer tubes near the zoarial margin.
15. A zoarium, × 12, preserving the ancestrular region where the tubes are shorter than usual.
Cretaceous (Vincentown marl) : Vincentown, New Jersey.

PLATE 4.

FIGS. 1, 2. *Trigonoecia transversa*, new species .... page 19.
An ovicelled zoarium, × 6, and portion, × 12, showing two ovicells (one broken) and the small oeciostome.
Jurassic (Bathonian) : Shipton Gorge, Dorset, England.

FIG. 3. *Cardioecia neocomiensis* D'Orbigny, 1852 .... page 19.
Portion of a frond, × 12, with two ovicells. The cordiform shape of the ovicell and the small oeciostome are visible.
Lower Cretaceous (Valangian) : Sainte Croix (Vaud), Switzerland.

FIG. 4. *Mecynoecia gracilis*, new species .... page 12.
The type specimen, × 12, a free unilamellar zoarium with the characteristic ovicell.
Jurassic (Bathonian) : Shipton Gorge, Dorset, England.

FIG. 5. *Trigonoecia verrucosa* Milne Edwards, 1838 .... page 18.
Portion of the encrusting zoarium, × 12, bearing an ovicell.
Jurassic (Bathonian) : Shipton Gorge, Dorset, England.

FIG. 6. *Nematifera reticulata* D'Orbigny, 1853 .... page 20.
Portion of a branch, × 12, exhibiting the characteristic salient threads outlining the zooecia.
Lower Cretaceous (Valangian) : Sainte Croix (Vaud), Switzerland.

FIG. 7. *Atractosoecia edwardsi* Canu, 1913 .... page 10.
Ovicelled portion of the incrusting zoarium, × 12, introduced for comparison with the following new species.
Jurassic (Bathonian) : Ranville (Calvados), France.

FIG. 8. *Atractosoecia walfordiana*, new species .... page 10.
Portion of the incrusting type specimen, × 12, exhibiting three ovicells.
Jurassic (Bathonian) : Shipton Gorge, Dorset, England.

PLATE 5.

FIGS. 1, 2. *Plagioecia compressa* Goldfuss, 1827 .... page 28.
1. View of a variety with small apertures exhibiting an ovicell resulting from the fusion of two secondary ovicells, × 12.
2. The ovicell of the normal form of the species, × 12.
Cretaceous (Coniacian), Tours (Indre-et-Loire), France.

FIGS. 3, 4. *Notoplagioecia magnipora*, new species .... page 30.
Two ovicelled branches, × 12, each preserving the small oeciostome.
Cretaceous (Coniacian), Tours (Indre-et-Loire), France.

FIG. 5. *Notoplagioecia flexuosa* D'Orbigny, 1853 .... page 31.
An ovicelled zoarium, × 12.
Cretaceous (Coniacian) Tours (Indre-et-Loire), France.

FIGS. 6–8. *Cavaria pustulosa* Hagenow, 1851 page 32.
6. Fragment, natural size.
7. An ovicelled example, × 12, showing also the thin slightly salient peristome.
8. An ovicelled example, × 12, composed of several lamellae.
Cretaceous (Danian), Herfolge, and Faxe, Denmark.

FIGS. 9–12. *Plagioecia obliqua* D'Orbigny, 1850 page 29.
9. A fragment, × 12, with an oval ovicell which deforms the zoarial margin.
10. An example, × 12, with a fusiform ovicell.
11. A specimen, × 12, in which the ovicell is placed near the zoarial margin.
12. A specimen, × 12, with a long fusiform ovicell.
Cretaceous (Coniacian), Tours (Indre-et-Loire), France.

PLATE 6.

FIGS. 1, 2. *Cea rustica* D'Orbigny, 1852 page 37.
1. Zoarium enlarged, showing the funnel shape of the orifice.
2. Transverse section, × 12, illustrating the thick zoarial walls.
Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

FIGS. 3–9. *Cea compressa* D'Orbigny, 1852 page 37.
3, 4. Lateral and end views of extremity of zoarium, enlarged, showing the zone of growth on the basal lamella.
5. Zooecial orifices exhibiting form when the oral tongue is completely developed and perforated (figs. 1, 3–5 after D'Orbigny, 1852).
6. Aspect, × 43, when the oral tongue is incompletely developed.
7. Zoarium, × 12, provided with an ovicell (figs. 6, 7. After Filliozat, 1917).
8. Longitudinal section showing the thickening of the walls at the extremity of the tubes.
9. Longitudinal section of a single wall, highly magnified (figs. 8, 9, after Pergens, 1883).
Cretaceous (Coniacian), Tours (Indre-et-Loire), France.

FIG. 10. *Cea lamellosa* D'Orbigny, 1852 page 37.
Zoarium with three ovicells, × 12.
Cretaceous (Coniacian), Villedieu (Loir-et-Cher), France

FIG. 11. *Cea tubulosa* D'Orbigny, 1852 page 37.
An ovicelled example. × 235. (After Filiozat, 1907).
Cretaceous, Bessé (Sarthe), France.

FIGS. 12–14. *Cea subcompressa* D'Orbigny, 1852 page 37.
12. Zoarial fragment, × 25, showing the orifice of the tubes.
13. An example, × 12, with a convex ovicell.
14. Another example, × 12, in which the ovicell is flat.
Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

PLATE 7.

FIGS. 1–3. *Stathmepora johnstrupi* Pergens, 1886 page 40.
1. Zoarial fragments, natural size.
2. An example, × 12, preserving a broken ovicell.
3. A typical specimen, × 12, with well-developed complete ovicell.
Cretaceous (Danian), Faxe, Denmark.

FIGS. 4, 5. ***Stathmepora gabbiana*** Ulrich and Bassler………… page 39.
Unovicelled and ovicelled branches of this species, × 12.
Cretaceous (Vincentown marl). Vincentown, New Jersey.

FIG. 6. ***Laterocea simplex*** D'Orbigny, 1852………… page 38.
An ovicelled zoarium, × 12. The oeciopore is a quite minute opening.
Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

FIGS. 7–10. ***Cea (Filicea) regularis*** D'Orbigny, 1852………… page 37.
7. A zoarium, natural size.
8. Portion of a branch enlarged, showing the form of the orifices (figs. 7, 8. After D'Orbigny, 1852).
9. Tangential section, × 25, showing the structure of the thickened wall.
10. Branch showing some zooecia with the oral tongue completely developed (after Filliozat, 1907).
Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

FIG. 11. ***Diaperoecia polystoma*** Roemer, 1839………… page 41.
Portion of an ovicelled example, × 12.
Cretaceous (Neocomian). Gross Wahlberg, Germany.

FIG. 12. ***Diaperoecia papillosa*** Reuss, 1846………… page 42.
An entire zoarium, × 12, provided with two ovicells.
Cretaceous, Chatham, England.

PLATE 8.

FIGS. 1–6. ***Diaperoecia turonica***, new species………… page 42.
1. An example, × 12, with a large elongated ovicell.
2. Upper portion of a frond, × 25, showing elongated tubes. The growth occurs laterally and superiorly.
3. An ovicelled frond, × 12, in which the zooecia are arranged as in *Reticulipora* and as in *Mesenteripora*.
4. A lamella, × 12, in the *Reticulipora* form of growth, showing the basal lamella and the zone of growth.
5. A lamella, × 12, in the *Mesenteripora* form bearing an elliptical ovicell.
6. Mature portion, × 25, showing short tubes and complete peristomes.
Cretaceous (Turonian): Ruillé Poncé (Loir-et-Cher), France.

FIG. 7. ***Diaperoecia transversata***, new species………… page 44.
The type specimen, × 12.
Cretaceous (Danian) Herfalge (Seeland), Denmark.

FIGS. 8–10. ***Diaperoecia punctata***, new species………… page 44.
8, 9. The narrow ramose zoarium, × 12, with an ovicell developed.
9. Opposite side of the same specimen, × 12.
10. The same specimen, × 25, showing the punctations more clearly.
Cretaceous (Danian); Herfolge (Seeland), Denmark.

FIG. 11. ***Idmonea magna*** Canu and Bassler, 1920………… page 50.
An ovicelled example, ×12, of this very abundant species which seldom shows an ovicell.
Eocene (Jacksonian): Jackson, Mississippi.

FIGS. 12. ***Diaperoecia saillons***, new species………… page 43.
The incrusting zoarium, × 12.
Cretaceous (Vincentown marl): Vincentown, New Jersey.

PLATE 9.

FIGS. 1–5. ***Diaperoecia compressa***, new species………… page 45.
1. Fragments of the bifoliate zoarium, natural size.
2–4. Three fragments, × 12, bearing the ovicell which is never wider than a branch.

5. Surface, × 25, exhibiting the prominent threads separating the zooecia.
Cretaceous (Danian), Herfolge (Seeland), Denmark.

FIGS. 6–10. *Diaperoecia americana* Gabb and Horn, 1862 page 46.
6. Fragment of the solid ramose zoarium, natural size.
7. End of a branch, × 12, with a thick zone of growth.
8. A typical unovicelled branch, × 12.
9. An ovicelled branch, × 12, bearing tubes wider apart than usual.
10. An abnormal branch, × 12, in which the tubes of the lower portions are growing in the opposite direction.
Cretaceous (Vincentown marl): Vincentown, New Jersey.

FIGS. 11–18. *Stigmatoechos punctatus*, Marsson, 1887 page 48.
11, 12. Celluliferous and dorsal sides of a branch, enlarged.
13, 14. Longitudinal and cross sections, enlarged (figs. 11–14, after Marsson).
15, 16. Lateral and celluliferous sides of an ovicelled example, × 12.
17. Non celluliferous side of the same zoarium, × 12, showing the smooth dorsal.
18. Celluliferous side, × 25.
Cretaceous (Danian): Faxe, Denmark.

FIG. 19. *Diaperoecia distans* Hagenow 1851 page 45.
An ovicelled example, × 12.
Cretaceous (Danian): Herfolge (Seeland), Denmark.

FIG. 20. *Diplosolen lineatum* Gabb and Horn, 1862 page 47.
The hollow ramose zoarium, × 12, with an ovicell.
Cretaceous (Vincentown marl): Vincentown, New Jersey.

FIGS. 21–22. *Diplosolen entalophoroides* new species page 47.
21. The solid ramose zoarium, × 12, showing the ovicell wider than the branch.
22. A portion of the same specimen, × 25, illustrating the occurrence of the small zooeciules and the separating threads between the zooecia.
Cretaceous (Danian): Faxe, Denmark.

PLATE 10.

FIGS. 1–5. *Pleuronea fenestrata* Busk, 1859 page 50.
1. Edge view of a branch, × 12; the ovicell is placed laterally and borders on the dorsal.
2. Frontal, × 12, showing the lateral ovicell bordering on the median axis.
3. A fragment, × 12, with a median subsymmetrical ovicell.
4. Celluliferous side, × 25.
5. Dorsal side, × 25; the tergopores open at the bases of deep sulci.
Eocene (Jacksonian): Jackson, Mississippi.

FIG. 6. *Plagioecia divagans* Canu and Bassler, 1920 page 27.
An ovicelled zoarium, × 12.
Eocene (Jacksonian): Jackson, Mississippi.

FIGS. 7–19. *Terebellaria ramosissima* Lamouroux, 1821 page 34.
7. An unbranched specimen, natural size.
8. Young example, natural size.
9, 10. Very young zoarium, natural size and enlarged.
11. Portion of specimen (fig. 8) enlarged (figs. 7–11, after Haime, 1854).
12, 13. Lateral and end views of a branch, enlarged.
14. Surface enlarged, showing zones of apertures separated by zones of dactyleturae.
15. Longitudinal section, enlarged (figs. 12–15, after D'Orbigny, 1853).
16. Longitudinal thin section, × 10, through end of branch (after Gregory 1896).

17. End of a branch, enlarged (after D'Orbigny, 1853).
18. Transverse thin section across branch, × 10 (after Gregory, 1896).
19. Photograph of surface, × 12, showing ovicells; branch inverted to illustrate form of ovicell.
    Jurassic, of France and England.

PLATE 11.

FIGS. 1–5. *Platonca scalaria*, new species______________ page 49.
1. Fragments of the branching zoarium, natural size.
2. An ovicelled branch, × 12, with the fascicles alternately arranged and showing the oeciostome adjacent to a tube.
3. A branch, × 12, with the ovicell at the bifurcation.
4. An ovicelled example, × 12, with the fascicles opposite each other; the ovicell lacks the oeciostome.
5. A small, basal, ovicelled branch, × 12; the oeciostome is isolated.
    Recent: Philippine Islands, Sirun, Tawi Tawi group.

FIGS. 6, 7. *Platonea hirsuta*, new species______________ page 49.
    The type specimen natural size and × 12.
    Recent: Philippine Islands, Sirun, Tawi Tawi group.

FIGS. 8–10. *Tennysonia stellata* Busk, 1867______________ page 51.
8, 9. Portions of two zoaria, natural size.
10. Enlargement of a frond showing the zooecia separated by numerous mesopores.
    Recent: Cape of Good Hope.

FIGS. 11–14. *Lobosoecia semiclausa* Michelin, 1846______________ page 52.
11. Fragment, natural size.
12. Portion of an ovicelled zoarium, × 12.
13. Posterior (inferior) side of the same specimen, × 12.
14. Transverse section, × 12.
    Recent: Port Elizabeth, South Africa.

PLATE 12.

FIGS. 1–3. *Lichenopora burdigalensis* Duvergier, 1921______________ page 80.
1. Inferior side of type specimen, × 12.
2. Superior side of the same specimen, × 12, showing the digitate ovicell.
3. A portion, × 25, illustrating the tubes and cancelli.
    Miocene (Upper Burdigalian): Saucats (Gironde), France.

FIGS. 4–11. *Lobosoecia semiclausa* Michelin, 1846______________ page 81.
4. Fragments, natural size.
5. Ovicelled fragment, × 12, exhibiting the oeciostome turned toward the base.
6. Portion of the same, × 25.
7. Another ovicelled fragment, × 12, in which the ovicell is composed of lobes and covers all the subjacent tubes. The oeciostome is turned toward the top.
8, 9. An ovicelled branch, × 12 and × 25, in which all the subjacent tubes are not closed.
10. Unovicelled portion of branch, × 25, showing the structure of the zooecial areas (facettes).
11. Diagrammatic view of the facettes, enlarged (after Gregory, 1899).
    Cretaceous (Cenomanian): LeMans (Sarthe), France.

FIGS. 12–16. *Melicerititites magnifica* D'Orbigny, 1852 ---------- page 85.
- 12, 13. Two ovicells, × 12, showing variation in form.
- 14. An example, × 12, with well developed pyriform ovicell.
- 15. Open (broken) ovicell, × 20, showing underlying zooecia completely developed.
- 16. Similar ovicell, × 20, with underlying zooecia lacking the frontal calcified wall.

Cretaceous (Coniacian), Villedieu (Loire-et-Cher), France.

FIGS. 17–22. *Melicerititites angulosa* D'Orbigny, 1852 ---------- page 84.
- 17. An eleocellarium with a regenerated zooecium, × 20.
- 18. Ovicelled branch, × 12, showing one complete and one broken ovicell and several large eleocellaria.
- 19. An ovicelled branch, × 12, in which the oeciostome is transformed into an eleocellarium.
- 20. Distal end of open ovicell, × 66.
- 21. Distal part of open ovicell, × 34, viewed from the proximal end.
- 22. Transverse section of an ovicelled branch, × 14, of *M. magnifica* (figs. 12, 13, 15–17, 20–22, after Levinsen).

Cretaceous (Coniacian) Chatham, England (fig. 17), Villedieu and Tours, France.

PLATE 13.

FIGS. 1–4. *Melicerititites gracilis* Goldfuss, 1827 ---------- page 83.
- 1, 2. Well preserved, ovicelled branch, × 12 and natural size.
- 3. Ovicelled portion of the same specimen, × 12.
- 4. Surface, × 25, exhibiting the semilunar orifice and triangular peristomes.

Cretaceous (Cenomanian): Essen, Germany.

FIGS. 5–7. *Semimultelea escharoides* Goldfuss ---------- page 87.
- 5. Zoarium natural size, consisting of an elongated multilamellar mass.
- 6. View of apertures enlarged, given by Goldfuss.
- 7. Photograph of best preserved surface noted, × 12, showing the orifices and eleocellaria.

Cretaceous (Cenomanian): Essen, Germany.

FIG. 8. *Psilosolen capitiferax*, new species ---------- page 112.

End view of branch, × 12, showing ovicell.

Pleistocene: Santa Barbara, California.

FIGS. 9, 10. *Tretocycloecia pelliculata* Waters, 1879 ---------- page 110.
- 9. Tangential thin section, × 25, illustrating vesicular structure of walls.
- 10. Fragment of branch, × 12, showing usual aspect of zooecia and mesopores in upper fourth and the large ovicell below.

Pacific Ocean: Neah Bay, Washington.

FIGS. 11–13. *Entolophora* (*?Nematifera*) *roemeri* Levinsen ---------- page 20.
- 11, 12. Fragment natural size and × 12, showing the semielliptical orifices.
- 13. Surface of same, × 25, exhibiting a sort of eleocellarium.

Cretaceous (Cenomanian): Essen, Germany.

PLATE 14.

FIGS. 1–8. *Ceriocava corymbosa* Lamouroux, 1821 ---------- page 90.
- 1, 2. The branching zoarium, natural size and the surface, enlarged (after Michelin, 1847).
- 3, 4. Basal part of zoarium, natural size and an enlarged view of the tubes (after Haime, 1854).
- 5, 6. Surface of branch, × 12; the broken ovicells show the special walls.

7. Longitudinal thin section, enlarged (after Gregory, 1899).
8. Branch, × 12, showing two short but complete ovicells.
Jurassic (Bathonian): Ranville (Calvados), France.

FIG. 9. *Spiroclausa spiralis* D'Orbigny, 1854 page 92.
An ovicelled example, × 12, the ovicell being the smooth convex sack between the two spires.
Cretaceous (Maastrichtian): Maastricht, Holland.

FIGS. 10–12. *Meliceritites* (*Foricula*) *aspera* D'Orbigny, 1852 page 86.
Three views of the surface, × 20, illustrating the porelike interspaces.
Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

FIG. 13. *Meliceritites lamellosum* D'Orbigny, 1852 page 85.
Frond, × 12, exhibiting the ovicell and oeciostome.
Cretaceous (Coniacian): Villedieu (Loir-et-Cher), France.

FIGS. 14, 15. *Haplooecia straminea* Phillips, 1829 page 97.
14. Diagrammatic drawing of the type specimen, enlarged (after Gregory).
15. Photograph of another example, × 25.
Jurassic (Bathonian): Ranville (Calvados), France.

PLATE 15.

FIGS. 1–8. *Ripisoecia conifera* Lamouroux, 1821 page 94.
1. Small zoaria natural size, of the dwarfed form called *conifera*.
2, 3. Large branching zoaria natural size of the form *ramosa*.
4. Surface of a branch, × 12, illustrating the flabelliform, transversely wrinkled ovicell.
5. A frequent aspect of the zoarial surface, × 2, with some of the mesopores closed by a fragile epitheca.
6. Surface, × 25, in which the mesopores are open.
7. Portion of a branch, × 12, with salient peristome and both open and closed mesopores.
8. An example, × 12, in which the mesopores lack the calcareous lamella.
Jurassic (Bathonian): St. Aubin and Luc (Calvados), France.

FIGS. 9–12. *Cyclocites primogenitum*, new species page 88.
9. The narrow ramose zoarium, natural size.
10. Surface × 25, illustrating the hexagonal facettes and the orbicular aperture often closed by a calcareous lamella.
11. Fragment of surface, × 25, in which the facettes have been destroyed.
12. An ovicelled branch, × 12, showing a portion with the facettes preserved. The two ovicells placed side by side are little convex and their oeciostome is orbicular.
Jurassic (Bathonian): Ranville (Calvados), France.

PLATE 16.

FIGS. 1–7. *Grammecava dumetosa* Defrance, 1824 page 96.
1. The compressed branching zoarium, natural size.
2. Surface of branch, enlarged (figs. 1, 2, after Michelin, 1846).
3. End of a branch, × 12, without facettes.
4. Portion of same, × 25.
5, 6. An example, × 12, and portion, × 25, exhibiting the facettes and closed apertures.
7. End of a branch, × 12, showing the median lamella.
Jurassic (Bathonian): Ranville (Calvados), France.

FIGS. 8–13. *Chilopora guernoni* Haime, 1854 .... page 105.
- 8. Zoarial fragments, natural size.
- 9. An ovicelled frond, × 12.
- 10. Fragment, × 12, preserving tubes with the lip-like projection only in the lower half.
- 11. Frond, × 12, exhibiting the small ovicell.
- 12. View, × 25, of tube with the characteristic terminal lip.
- 13. Another portion of the surface, × 12, in which the lip is wanting.

Jurassic (Bathonian): Occaignes (Orne), France.

PLATE 17.

FIGS. 1–8. *Ditaxia parvipora*, new species .... page 103.
- 1. Zoarial fragments, natural size.
- 2. A fragment, × 6, with a narrow zoarial base.
- 3. Another fragment, × 6, showing the median lamella at the extremity of the branch.
- 4. Zoarial surface, × 25, illustrating the form of the zooecia and mesopores.
- 5. Another surface, × 25, in which the distinction between the two kinds of tubes is not so apparent.
- 6. An example, × 12, illustrating the normal form of the ovicell with the oeciostome at the center.
- 7. Another example, × 12, with the ovicell partially covered by the adjacent mesopores.
- 8. A specimen, × 12, with small tubes.

Cretaceous (Coniacian): St. Paterne and Tours (Indre-et-Loire), France.

FIGS. 9–13. *Ditaxia anomalopora* Goldfuss, 1827 .... page 101.
- 9. Fragments of the bilamellar zoarium, natural size.
- 10. Section of a branch, enlarged, showing the median lamella.
- 11. Edge of a branch enlarged showing the crest representing the median lamella.
- 12. Zoarial surface, enlarged (figs. 9–12, after Hagenow, 1851).
- 13. Portion of the surface of young example × 12, showing slightly salient peristomes.

Cretaceous (Maastrichtian): Maastricht, Holland.

FIGS. 14–16. *Chilopora cretacea*, new species .... page 106.
- 14. Portion of the zoarial surface × 25. The tubes have a salient lip.
- 15. An ovicelled example, × 12. The ovicell is globular and placed on the edge.
- 16. Another ovicelled example, × 12. The ovicell is broken showing its interior.

Cretaceous (Santonian): Vendomé (Loire-et-Cher), France.

PLATE 18.

FIGS. 1–4. *Alveolaria semiovata* Busk, 1859 .... page 111.
- 1. Top view of the zoarium, natural size.
- 2. Lateral view of zoarium, natural size, broken to show the structure.
- 3. Two of the subcolonies, × 12, each with an ovicell.
- 4. Edge view of zoarium, × 6, illustrating its formation by cupshaped subcolonies.

Pliocene (Plaisancian): Sudbourne Church, Suffolk, England.

FIGS. 5–9. *Tretocycloecia sabaudica*, new species .... page 110.
- 5. The ramose zoarium, natural size.

6. Surface of the same, × 25, showing a portion with open mesopores.
7. An ovicell, × 12, with the external wall broken away.
8. Zoarial surface, × 25, exhibiting mesopores closed by a calcareous lamella.
9. Another surface, × 12, with a zone of open mesopores and a zone of closed ones.

Cretaceous (Greensand): Chamboy (?France).

PLATE 19.

FIGS. 1–9. *Filicrisina verticillata* D'Orbigny, 1852 ------ page 137.

1. Zoarial fragments, natural size.
2. Dorsal side of branch, × 25. At the top the facettes inclosing the dactylethrae are lozenge shape and perforated by a longitudinal slit. At the bottom the second calcareous layer bears round orifices.
3. Dorsal surface, × 25. Here the orifice of the lozenge-shaped facettes is little elongated and is not surrounded by a salient peristome.
4. Dorsal surface, × 25, with a second calcareous layer in which case the orifice perforating the facette has a round salient peristome.
5. Frontal surface, × 25, with tubes having salient peristomes.
6. Frontal side, × 12, with peristomes little salient.
7. Another frontal, × 12, in which the quincunx arrangement of the peristomes is apparent.

8, 9. Two ovicelled fragments, × 12, showing lateral position of ovicells.

Cretaceous (Campanian): Longuesse (Seine-et-Oise), France.

FIG. 10. *Cavarinella ramosa* Marsson, 1887 ------ page 135.

An ovicelled specimen, × 12, showing position of the genus *Cavarinella* in the Ascosoeciidae.

Cretaceous (Danian): Herfolge (Seeland), Denmark.

FIG. 11. *Parascosoecia marssoni* Gregory, 1899 ------ page 115.

Fragment with ovicell, × 12.

Cretaceous (Danian): Herfolge (Seeland) Denmark.

FIG. 12. *Parascosoecia francqana* D'Orbigny, 1852 ------ page 115.

Specimen, × 12, exhibiting ovicell of the Ascosoeciidae.

Cretaceous (Danian): Herfolge (Seeland), Denmark.

FIGS. 13–18. *Sulcocava cristata* D'Orbigny, 1854 ------ page 134.

13. Edge of zoarial fragment, × 12, showing ovicell.
14. Broad side of branch, × 12, traversed by longitudinal sulci.
15. Portion, × 25, showing small vacuoles at base of the sulci.
16. Broad side of ovicelled branch, × 12, showing ovicell on edge.
17. Edge of a broad branch, × 12.
18. Edge view of the extremity of a branch, × 12.

Cretaceous (Coniacian): Tours (Indre-et-Loir), France.

PLATE 20.

FIGS. 1–8. *Polyascosoecia coronopus*, new species ------ page 126.

1. Zoarial fragments, natural size.
2. Zoarium with expanded base, × 6.
3. Lateral view of an ovicelled branch, × 12.
4. Anterior side of branch with broken ovicell, × 12, showing that it is a vesicle arranged above the tubes.
5. Another ovicelled example, × 12. The tubes of the fascicles surrounded by the ovicell have a slightly larger diameter.

6. Frontal face of a zoarium showing tubes and mesopores, × 25.
7. Posterior or dorsal side, × 25, exhibiting vacuoles.
8. Zoarial fragment, × 6, with a subsymmetrical ovicell surrounding four fascicles.

Miocene (Helvetian): Mus (Gard), France.

FIGS. 9–14. *Crisina normaniana* D'Orbigny, 1852 page 118.

9. Zoarium, natural size.
10–12. Lateral, dorsal and frontal views of a fragment showing aspect of zooecial tubes on the frontal face and of the vacuoles on the dorsal side, (figs. 9–12, after D'Orbigny, 1852).
13, 14. Lateral and frontal view of an ovicelled branch, × 12.

Cretaceous (Coniacian): Fecamp (Seine inferiore), France.

FIGS. 15–21. *Crisina triangularis* D'Orbigny, 1851 page 118.

15–17. Frontal, dorsal, and lateral views of a branch, magnified.
18. Dorsal side, magnified, showing the vacuoles (figs. 15–18, after D'Orbigny, 1852).
19, 20. Transverse and longitudinal sections, magnified (after Marsson).
21. Tangential section of the dorsal, × 25, showing the orifice of the vacuoles.

Cretaceous (Coniacian): Tours (Indre-et-Loire), etc., France.

PLATE 21.

FIGS. 1–6. *Grammanotosoecia contorta*, new species page 123.

1. Zoarial fragments, natural size.
2. Surface of an example, × 12, showing two ovicells.

Cretaceous (Campanian): Brossac (Charente), France.

3. A fragment, × 12, in which the orifices are arranged in groups.
4. The same specimens, × 25.

Cretaceous (Santonian): Saint Bonnier (Charente), France.

5. An example × 12, in which the orifices are large and arranged as in *Zonopora*.
6. Portion of the same specimen × 25.

Cretaceous (Santonian): Saint Medard (Charente), France.

FIGS. 7, 8. *Grammascosoecia parvipora*, new species page 122.

7. The cylindrical zoarium, natural size.
8. The same, × 12, illustrating the ovicell.

Cretaceous (Maastrichtian): Maastricht, Holland.

FIGS. 9, 10. *Grammascosoecia porosa*, new species page 121.

9. Zoarial surface × 12, showing the arrangement of the zooecial orifices around elliptical porous areas formed of mesopores.
10. View of the same surface, × 25.

Recent: South Africa.

PLATE 22.

FIGS. 1–5. *Reteporidea royana* D'Orbigny, 1854 page 129.

1. Zoarium natural size.
2. Anterior (celluliferous) side of branch, enlarged, showing the tubes and mesopores.
3. Posterior (dorsal) side enlarged, exhibiting the vacuoles.
4. A further enlargement of the anterior side.
5. Edge view of branch, enlarged, showing tubes to the left and vacuoles to the right (figs. 1–5 after D'Orbigny, 1850).

Cretaceous (Maastrichtian): Royan, etc., France.

FIGS. 6–9. *Reteporidea subramosa*, new species ---------- page 133.

6. Fragments of the free, branched zoarium, natural size.
7. Celluliferous side, × 12, showing the zooecial tubes and the numerous intervening mesopores.
8. Dorsal side, × 12, with vacuoles.
9. Portion of fig. 7, × 25.

Cretaceous (Campanian): Meudon, near Paris, France.

FIGS. 10–15. *Reteporidea collardeti*, new species ---------- page 132.

10. Small fragments of the reticulate zoarium, natural size.
11. Celluliferous face, × 12, with the peristomes in oblique rows.
12. Another fragment, × 12, with peristomes in transverse rows.
13. An ovicelled branch, × 12, showing ovicell perforated by the tubes.
14. Celluliferous (anterior) face, × 25.
15. Posterior side of zoarium, × 12, illustrating vacuoles.

Cretaceous (Campanian): Meudon near Paris, France.

FIGS. 16, 17. *Leiosoecia occlusa*, new species ---------- page 100.

The free claviform zoarium, natural size and × 12. An ovicell (broken) is present near the top.

Cretaceous (Cenomanian): Essen, Germany.

PLATE 23.

FIGS. 1–6. *Osculipora truncata* Goldfuss, 1827 ---------- page 57.

1. Two fragments, natural size.
2. Celluliferous side, × 5, showing pinnules.
3. Lateral view of same, × 15.
4. An ovicell bearing branch, natural size and × 5, described by Hagenow as *Coelophyma laevis*.
5. Dorsal of branch, × 15, exhibiting the nematopores. (Figs. 1–5, after Hagenow, 1851.)
6. A fragment bearing the ovicell at the bifurcation of the branch.

Cretaceous (Maastrichtian): Maastricht, Holland.

FIG. 7. *Osculipora repens* Hagenow, 1851 ---------- page 57.

Bifurcated fragment showing the ovicell on the anterior side.

Cretaceous (Maastrichtian): Royan, France.

FIGS. 8, 9. *Osculipora houzeaui* Pergens, 1894 ---------- page 57.

Frontal and dorsal views of a zoarium, × 13, the latter showing the ovicell (after Pergens, 1894).

Cretaceous (Maastrichtian): Faquemont, Holland.

FIGS. 10, 11. *Osculipora royana* D'Orbigny, 1850 ---------- page 58.

10. A fragment, × 12, showing the smooth, globular, lateral ovicell.
11. Anterior face of a fragment with two lateral ovicells, × 12.

Cretaceous (Maastrichtian): Royan (Charente Inferieure), France.

FIGS. 12–16. *Plethoporella ramulosa* D'Orbigny, 1853 ---------- page 56.

12. An incomplete zoarium, natural size.
13. Surface enlarged somewhat.
14. A longitudinal section, enlarged (figs. 12–14, after D'Orbigny, 1853).
15. Surface, × 12, preserving an ovicell.
16. A broken ovicell, × 12, showing the interior.

Cretaceous (Maastrichtian): Royan, France.

FIG. 17. *Plethopora malmi* Hennig, 1894.

A longitudinal section, × 9, showing the zooecia (*z*) and the strengthening pores (*f*) (after Hennig, 1894).

Cretaceous of Sweden.

PLATE 24.

FIGS. 1–7. *Homoeosolen gamblei* Gregory, 1909........................ page 62.

1. Anterior face, × 12, showing a quite convex ovicell (broken) with its oeciostome.
2. Anterior side of a branch, × 12, with the ovicell deeply embedded.
3. Inferior or dorsal side of the branch, × 12.
4. Branch with a broken ovicell showing the internal wall, × 12.
5. A well-developed branch, × 25, with a median ovicell.
6. Longitudinal thin section, × 12, showing the form of the tubes.
7. A meridian section, × 10 (after Gregory 1909).

Cretaceous (Turonian): Ste. Calais (Sarthe), France.

FIGS. 8–14. *Homoeosolen ramulosus* Lonsdale, 1850................. page 61.

8, 9. Two branches, × 12, showing the ovicell on the anterior face.

10. A longitudinal section, × 12, illustrating the expanded tubes.

Cretaceous (Coniacian): Chatham, England.

11, 12. Obverse and reverse sides of a young zoarium, × 10.

Cretaceous: Charing, Kent, England.

13. Part of a branch with an entire pinnule and an ovicell developed, × 10.

14. Longitudinal section through the end of a branch, × 9, showing the simple tubulate form of the zooecia (figs. 11–14, after Gregory, 1909).

Cretaceous (Coniacian): Chatham, England.

PLATE 25.

FIGS. 1, 2. *Truncatula pinnata* Roemer, 1840........................ page 64.

Two portions of the same zoarium, × 12, showing the ovicell which here occupies abnormal places instead of its usual lateral position, on account of the irregular character of the zoarium.

Cretaceous (Cenomanian): Le Mans (Sarthe), France.

FIGS. 3–5. *Truncatula subpinnata* D'Orbigny, 1854................. page 66.

3. Side view of branch, × 12, showing the lateral position of the ovicell. The broken ovicell above shows the structure of the internal wall.
4. An ovicelled branch, × 12, in which the nematopores are closed by a calcareous epitheca. The apertures of the tubes are visible at the extremities of the pinnules.
5. Dorsal side of an ovicelled branch, × 12, showing the open nematopores.

Cretaceous (Cenomanian): Le Mans (Sarthe), France.

FIGS. 6, 7. *Truncatula filix* Hagenow, 1851........................ page 64.

Two views, × 10, exhibiting the lateral position of the ovicells (after Gregory, 1909).

Cretaceous (Maastrichtian): Maastricht, Holland.

FIG. 8. *Truncatula plebeia* Novak, 1877.

Dorsal side, enlarged.

Cretaceous of Bohemia.

FIGS. 9–11. *Truncatula discoidea*, new species........................ page 69.

9. The discoid zoarium, × 6, viewed from below and showing the marginal ovicell.
10. Portion of the inferior face, × 12, showing the position of the ovicells between the pinnules.
11. Superior face of the same zoarium, × 12.

Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

PLATE 26.

FIGS. 1–4. *Semicytis disparilis* D'Orbigny, 1854 ---------------------- page 75.
1. Zoarium, natural size (after Gregory, 1909).
   Cretaceous: Gravesend, England.
2. A branch natural size.
3. Celluliferous side, enlarged showing the openings of the apertures.
4. Noncelluliferous side illustrating the nematopores (figs. 2–4, after D'Orbigny, 1854).
   Cretaceous of France.

FIGS. 5–7. *Semicytis fenestrata* D'Orbigny, 1852 ---------------------- page 76.
5. Obverse face of base of zoarium with an ovicell × 15 (after Gregory, 1909).
   Cretaceous (Coniacian): Chatham, England.
6. Posterior face, × 12, showing the orifices of the nematopores.
7. Anterior face illustrating the openings of the tubes.
   Cretaceous (Coniacian): Les Roches (Loir-et-Cher), France.

FIGS. 8–11. *Truncatula tetragona* Michelin, 1846 ---------------------- page 66.
8. A specimen, × 6, with closely spaced pinnules.
9. An example, × 6, exhibiting widely spaced pinnules.
10. Lateral view of a branch, × 12.
11. Posterior face, × 12, showing the orifices of the nematopores.
    Cretaceous (Turonian): Ruillé Poncé (Loir-et-Cher), France.

FIGS 12–16. *Truncatula vendocinensis*, new species ---------------------- page 69.
12. Zoarial fragments, natural size.
13. A zoarial base, × 6.
14. Anterior face, × 6.
15. Dorsal, × 12, showing the orifices of the nematopores.
16. Another dorsal, × 12, in which the nematopores are irregularly arranged.
    Cretaceous (Santonian): Vendome (Loir-et-Cher), France.

PLATE 27.

FIGS. 1–4. *Supercytis digitata* D'Orbigny, 1854 ---------------------- page 73.
1, 2. Profile of a colony, natural size and enlarged.
3. The same specimen viewed from above and showing two ovicells.
4. View of same from below.
   Cretaceous (Coniacian): Fecamp, etc., France.

FIGS. 5–11. *Unicytis falcata* D'Orbigny, 1854 ---------------------- page 73.
5, 6. Lateral views of specimen natural size and enlarged.
7. Posterior side, enlarged, showing the nematopores.
8. Anterior side with the zooecial apertures.
9. A cross section of a branch (figs. 1–9 after D'Orbigny).
10. A longitudinal section, × 12, showing the zone of nematopores to the right and the zooecia opening in the pinnules to the left.
11. Transverse section × 12, illustrating the thick zone of nematopores which almost surrounds the branch.
    Cretaceous (Santonian): Vendomê, France.

FIGS. 12–18. *Diplodesmopora alternata*, new species ---------------------- page 60.
12–14. Anterior, lateral and posterior sides of an ovicelled specimen, × 12.
15. Dorsal of an ovicelled specimen showing the conical zone of growth and the nematopores.
16–18. Three views of the same specimen illustrating the lateral ovicell.
    Cretaceous (Maastrichtian): Maastricht, Holland.

FIGS 19–25. *Diplodesmopora opposita*, new species .... page 80.

19 Lateral view of an example with a broken ovicell × 12. The fascicles are biserial and the nematopores are closed by an epitheca.

20. A worn example, × 12, with the dorsal nematopores visible.

21. Another example with a complete ovicell, × 12. The fascicles are uniserial and the nematopores are closed.

22 Transverse section, × 12, between the fascicles.

23. An incomplete transverse section, × 12, showing the zone of nematopores.

24. Transverse section, × 12, through the middle of the fascicles. The dorsal is very thick and is perforated by the nematopores.

25. Longitudinal section, × 12. The tubes are long, expanded with dorsal gemmation. They branch into dorsal nematopores which are long, rectilinear, with much thickened walls.

Cretaceous (Coniacian): Tours (Indre-et-Loire), France.

PLATE 28.

FIGS 1–7 *Desmepora semicylindrica* Roemer, 1840 .... page 77.

1 Lateral view of branch, × 12, showing the ovicell.

Cretaceous (Turonian): Fontaine d'Antoigne, near Chatellerault, France.

2, 3 Anterior view of a branch enlarged and cross section of the same (after Marsson.)

Cretaceous: Island of Rügen.

4. Zoarium, natural size.

5, 6. Posterior face enlarged

7. Anterior face enlarged (figs. 4–7, after Lonsdale).

Cretaceous of England.

FIGS. 8, 9 *Desmepora reussi* Gregory, 1909 .... page 77

Fragment, natural size, and enlarged.

Cretaceous (Cenomanian): Plauen, Saxony.

FIGS 10–15 *Discocytis eudesi* Michelin, 1844 .... page 71.

10, 11. Zoarium natural size and enlarged.

12. Section through the zoarium, enlarged.

13. Anterior side of the zoarium enlarged (figs. 10–13, after D'Orbigny, 1852).

14. Posterior side of zoarium showing arrangement of numerous ovicells

15. Part of another ovicell bearing zoarium, × 12.

Cretaceous (Cenomanian): LeMans (Sarthe), France.

FIG 16 *Discocytis eccentrica* Ulrich and Bassler, 1907 .... page 72

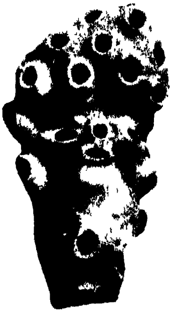
Portion of an ovicelled zoarium, × 12. The ovicell is a vesicle with special walls, situated on the edge of the zoarium and branched between the fascicles.

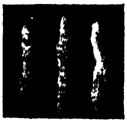
Cretaceous (Vincentown marl): Vincentown, New Jersey.

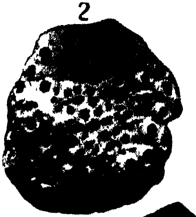
FIGS. 17. *Discocytis essenensis* Simonowitsch, 1871.

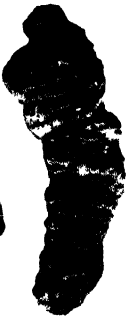
A median section through the zoarium enlarged (after Simonowitsch, 1871).

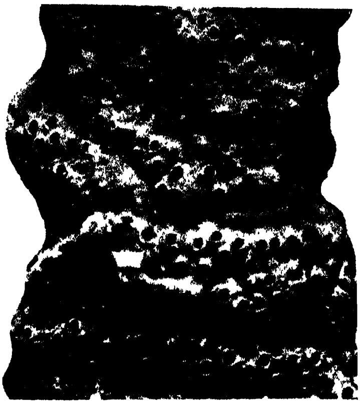
Cretaceous (Cenomanian): Essen, Germany.

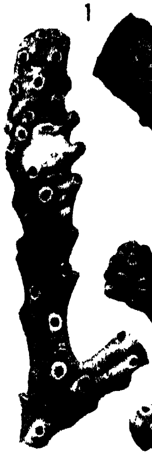

1

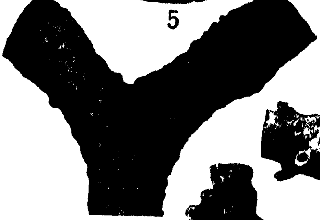

2

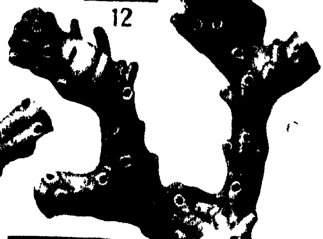

5

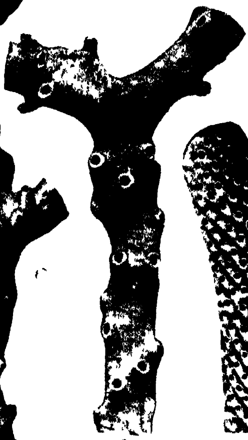

3


4

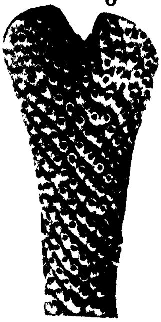

7

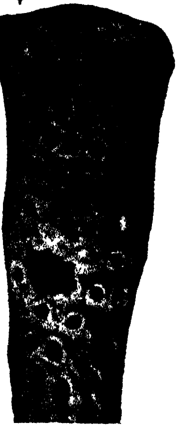

12

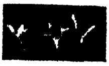

8

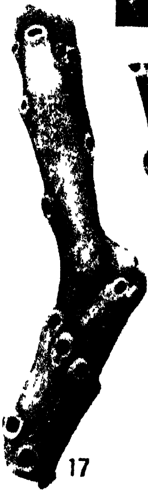

10

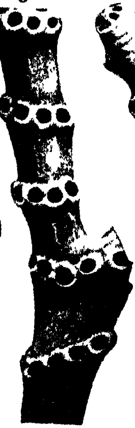
6

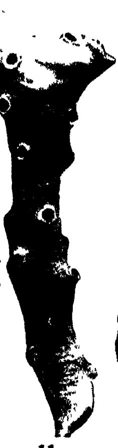

14

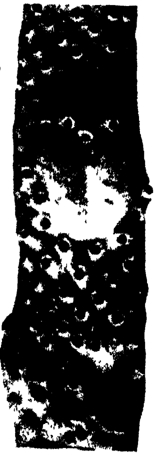

13

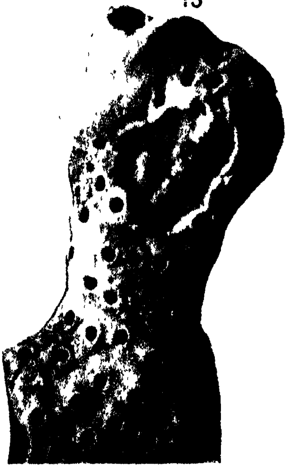

9


17


16

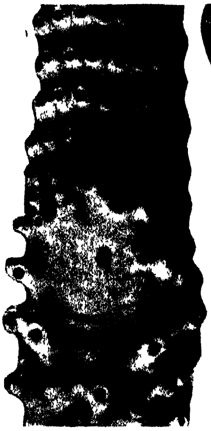

11

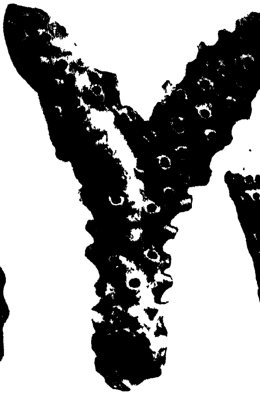

15


18

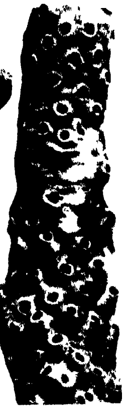
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

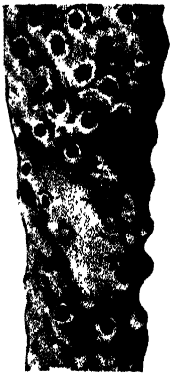
FOR EXPLANATION OF PLATE SEE PAGE 139


1

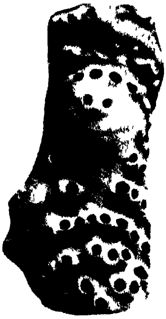

3

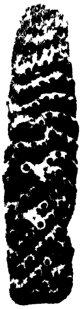
9

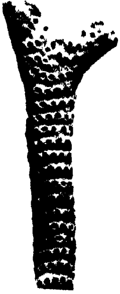

4

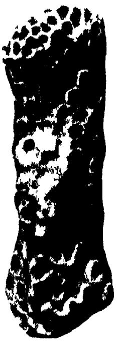

5

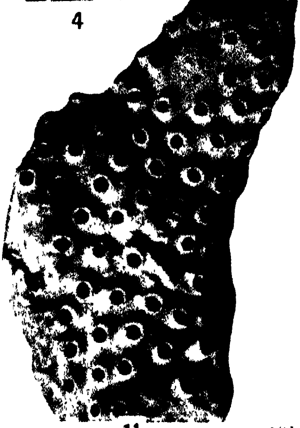
2

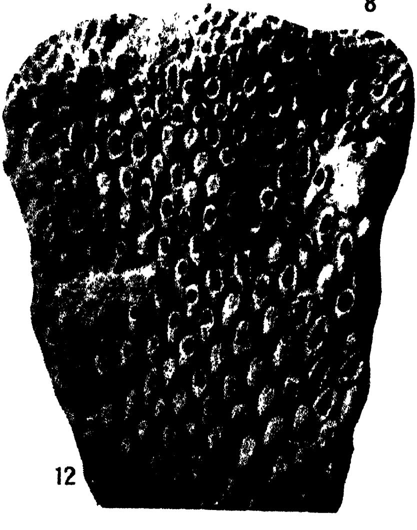

6

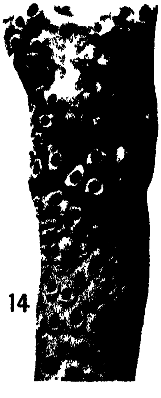

7

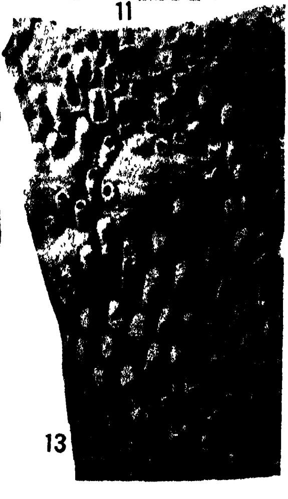

8


10


11

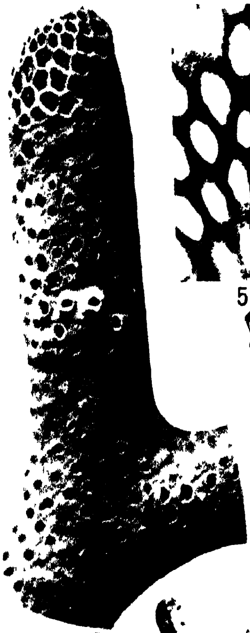

12

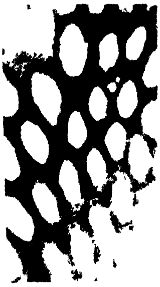

14

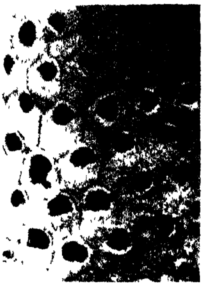

13

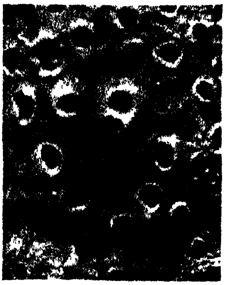
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

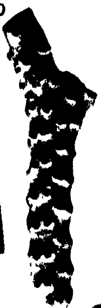
FOR EXPLANATION OF PLATE SEE PAGE 140

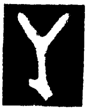

2


5

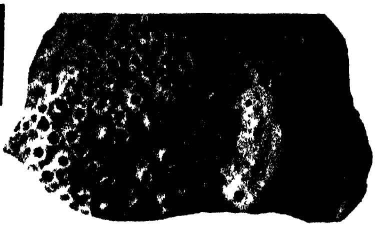

4

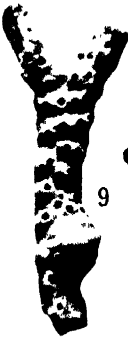

3

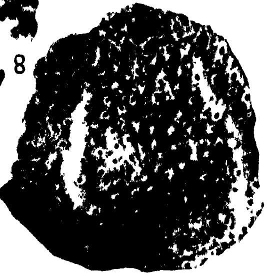

8


1

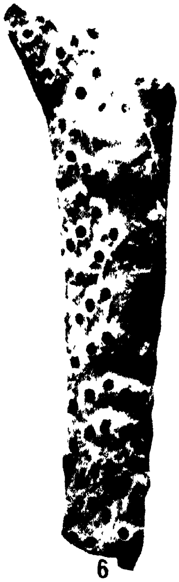
7

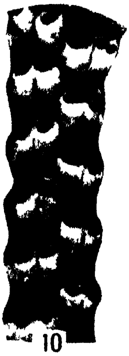

12


9

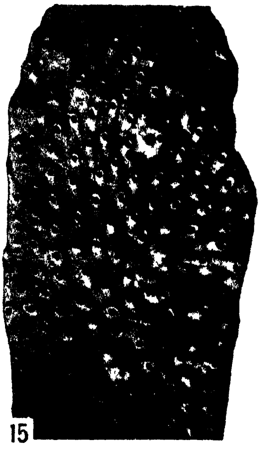

11

13


6

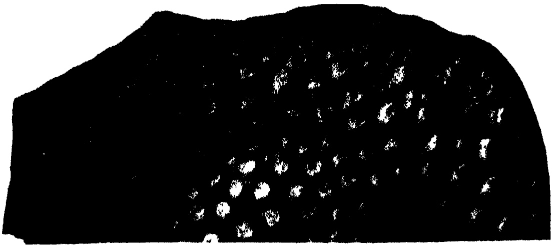

10

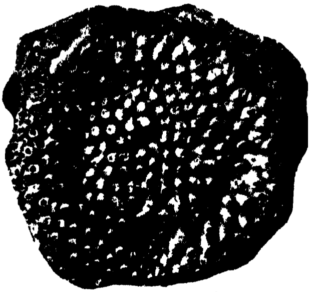
14


15

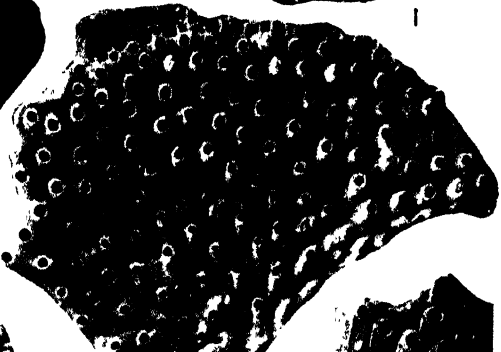
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

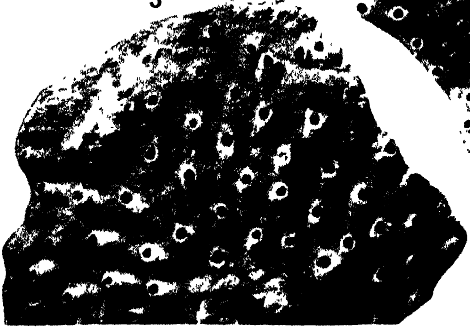
FOR EXPLANATION OF PLATE SEE PAGES 140-141

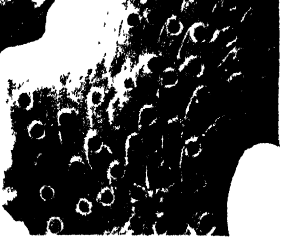

2

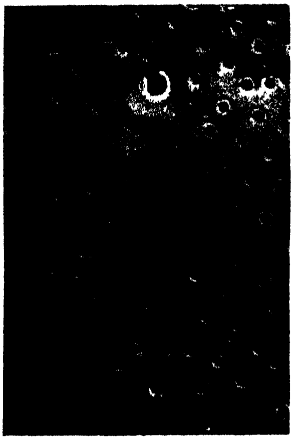

1

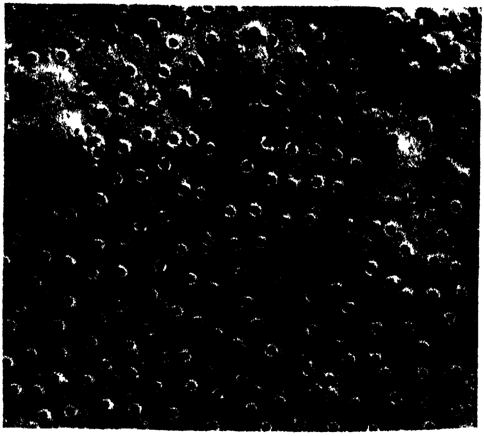
3


4


5


6

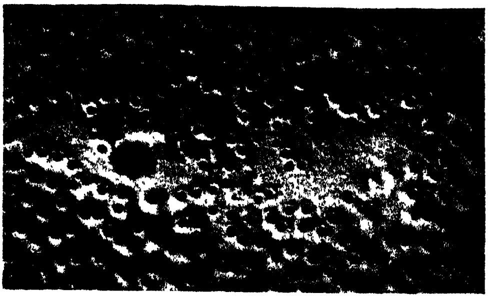

7

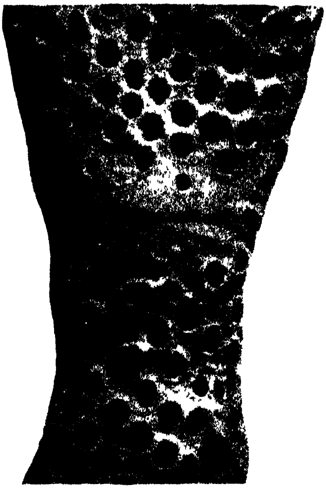

8

Fossil and Recent Cyclostomatous Bryozoa.

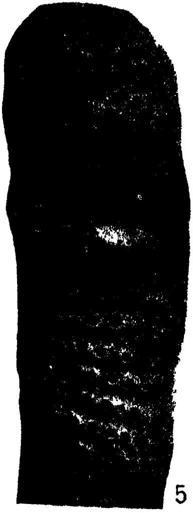
For explanation of plate see page 141.

1


2

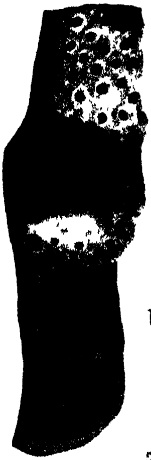

3

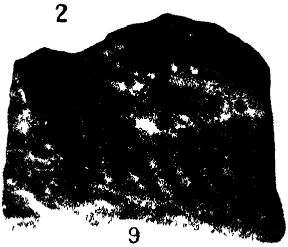
4

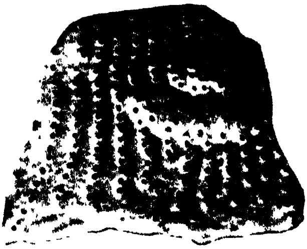

5

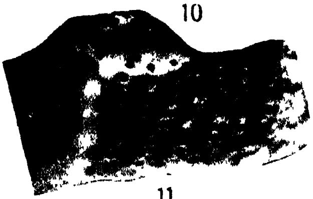
6

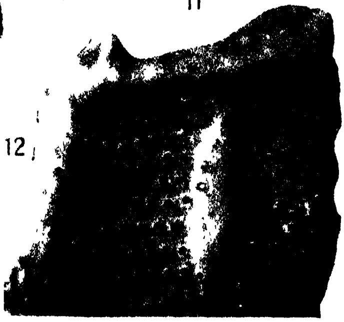
7


8


9

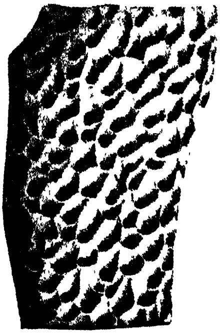

10


11

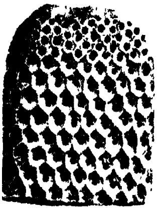

12

Fossil and Recent Cyclostomatous Bryozoa.

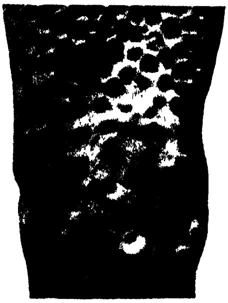
For explanation of plate see pages 141-142.



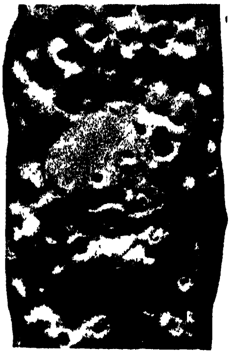
1



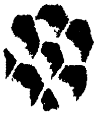
3



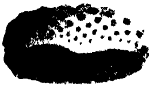
7



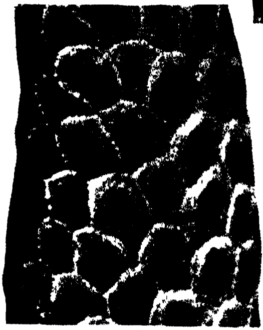
11



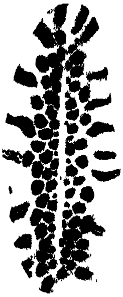
5



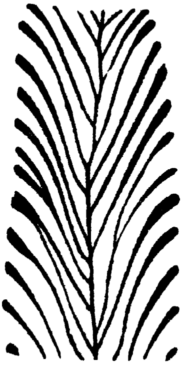
4



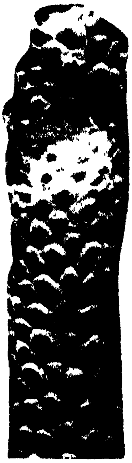
12



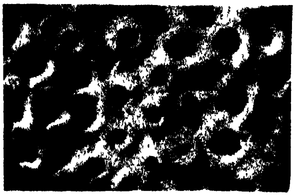
2



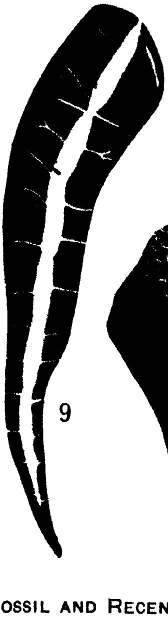
8



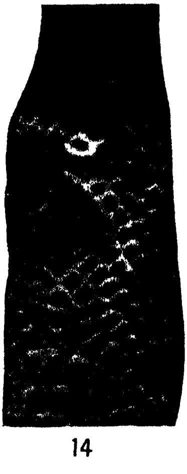
13



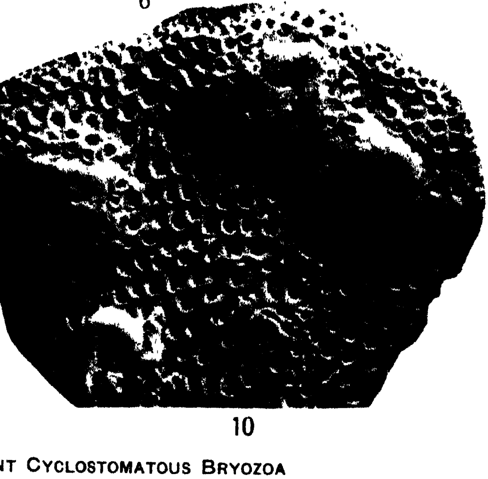
6



9



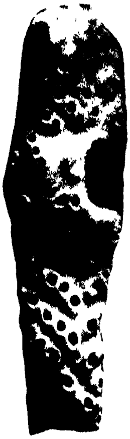
14

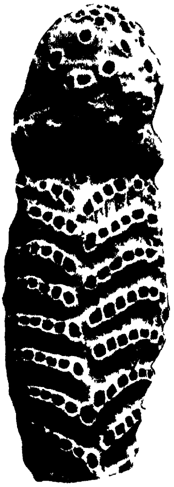


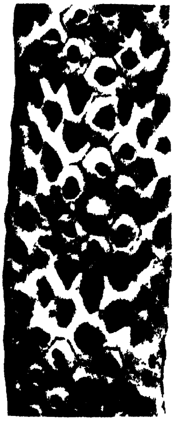
10

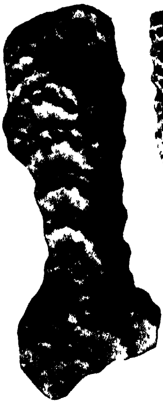
Fossil and Recent Cyclostomatous Bryozoa

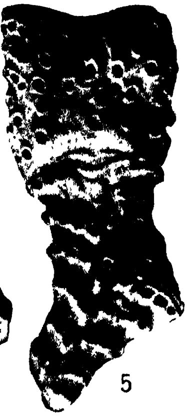
FOR EXPLANATION OF PLATE SEE PAGE 142.

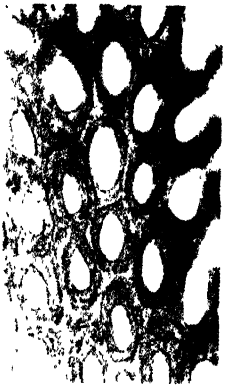

2


3

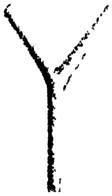

10

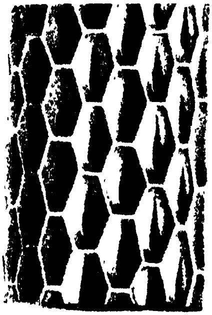

4

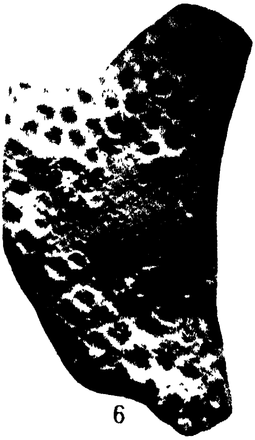

5

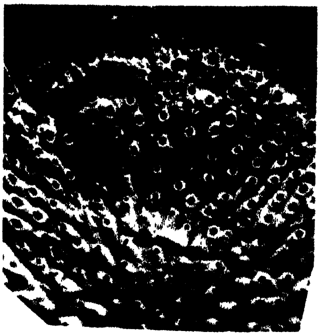

9

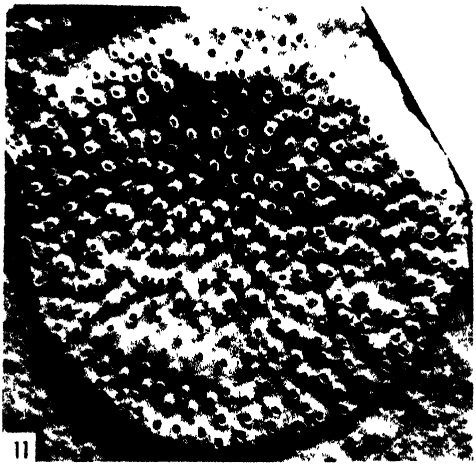
1


7


8

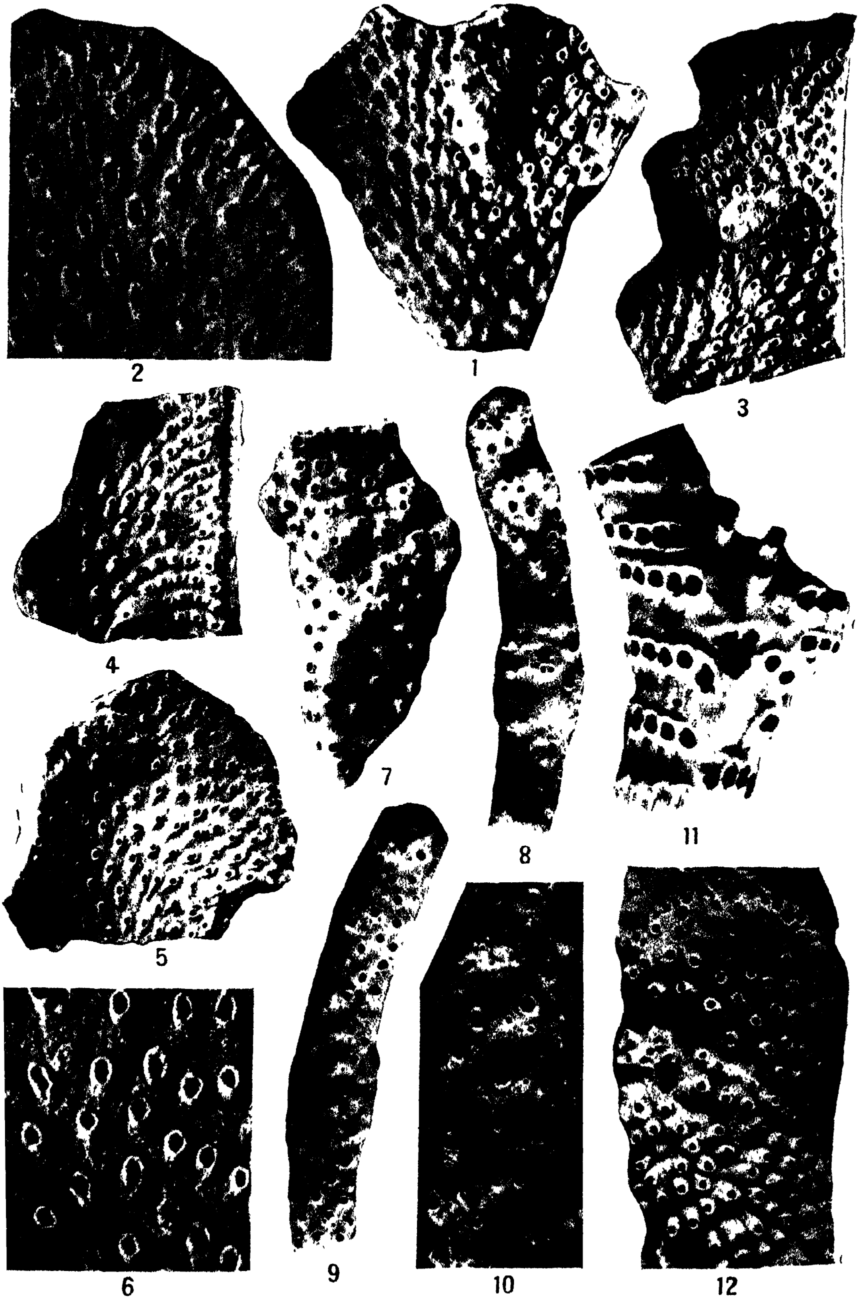

6


12


11

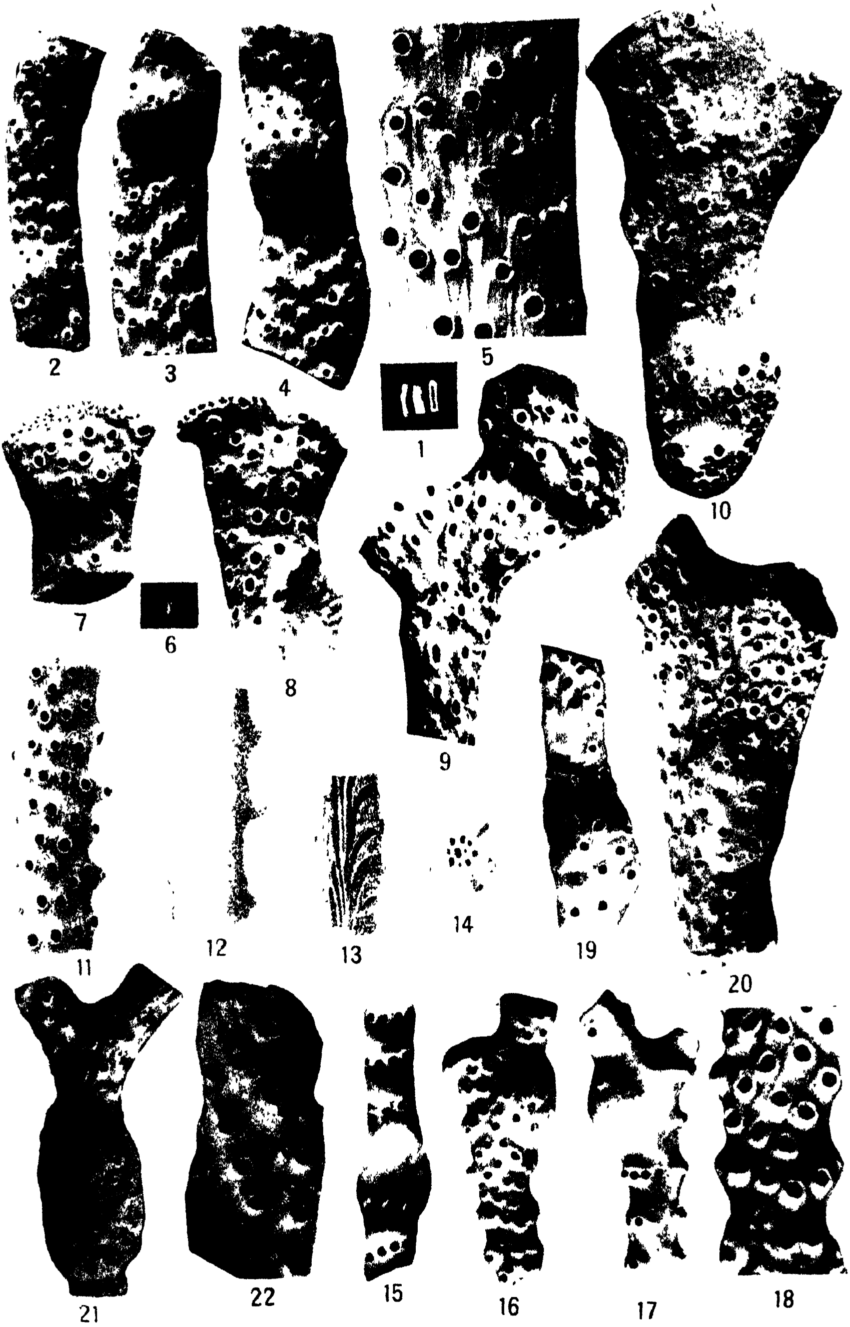
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 142 143



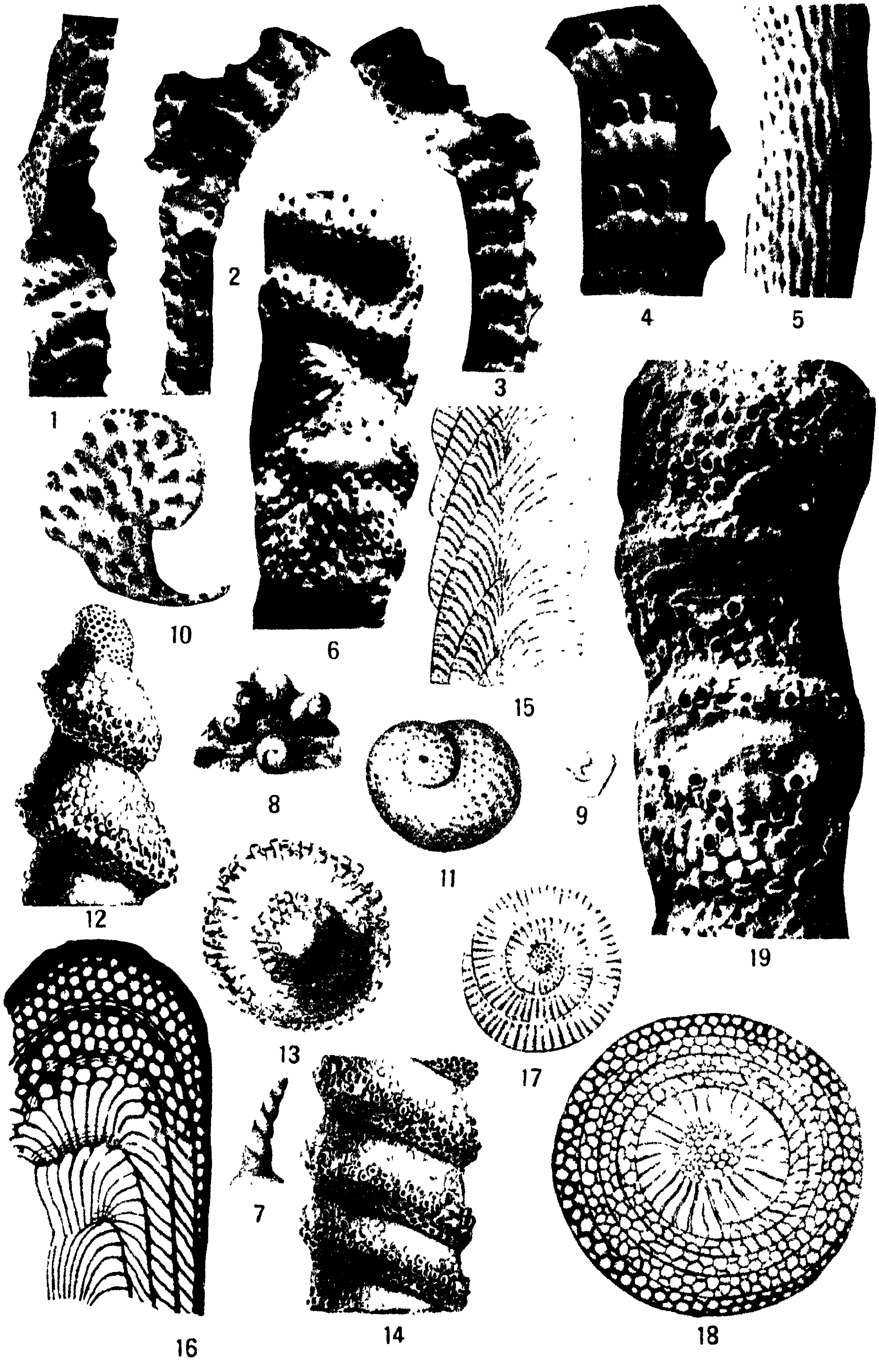
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA

FOR EXPLANATION OF PLATE SEE PAGE 133.



FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

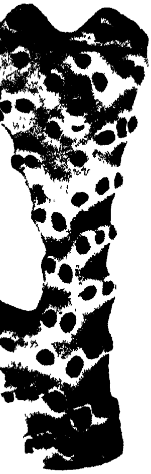
FOR EXPLANATION OF PLATE SEE PAGES 143-144.

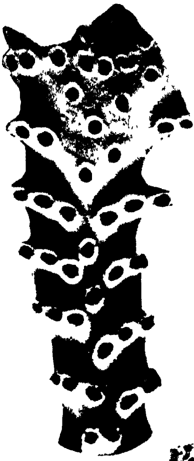


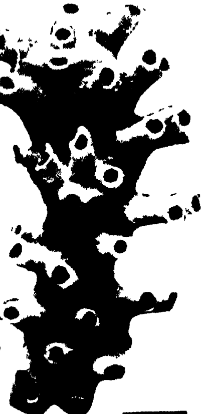
Fossil and Recent Cyclostomatous Bryozoa.

For explanation of plate see pages 144-146

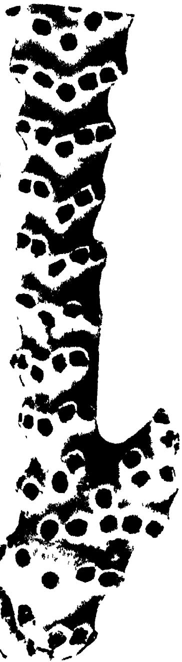
1

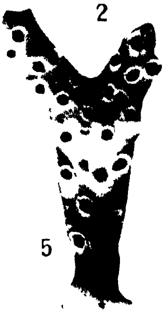

2

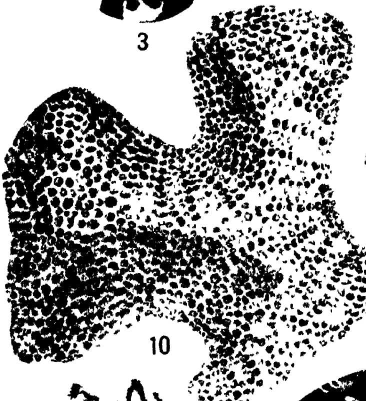

3


7

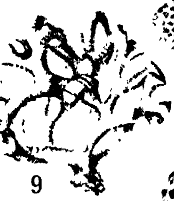
6

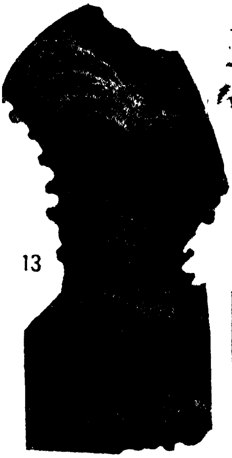

4


5

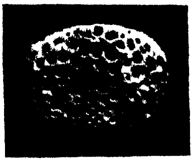

10

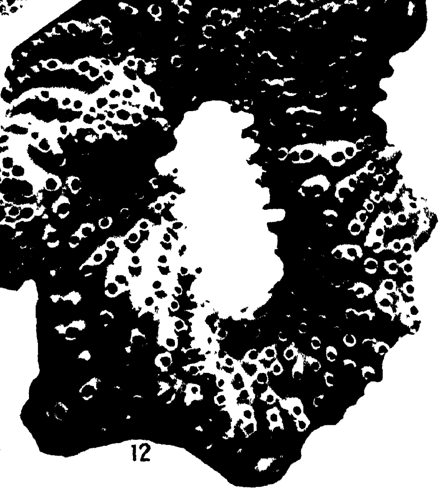
8


9


13

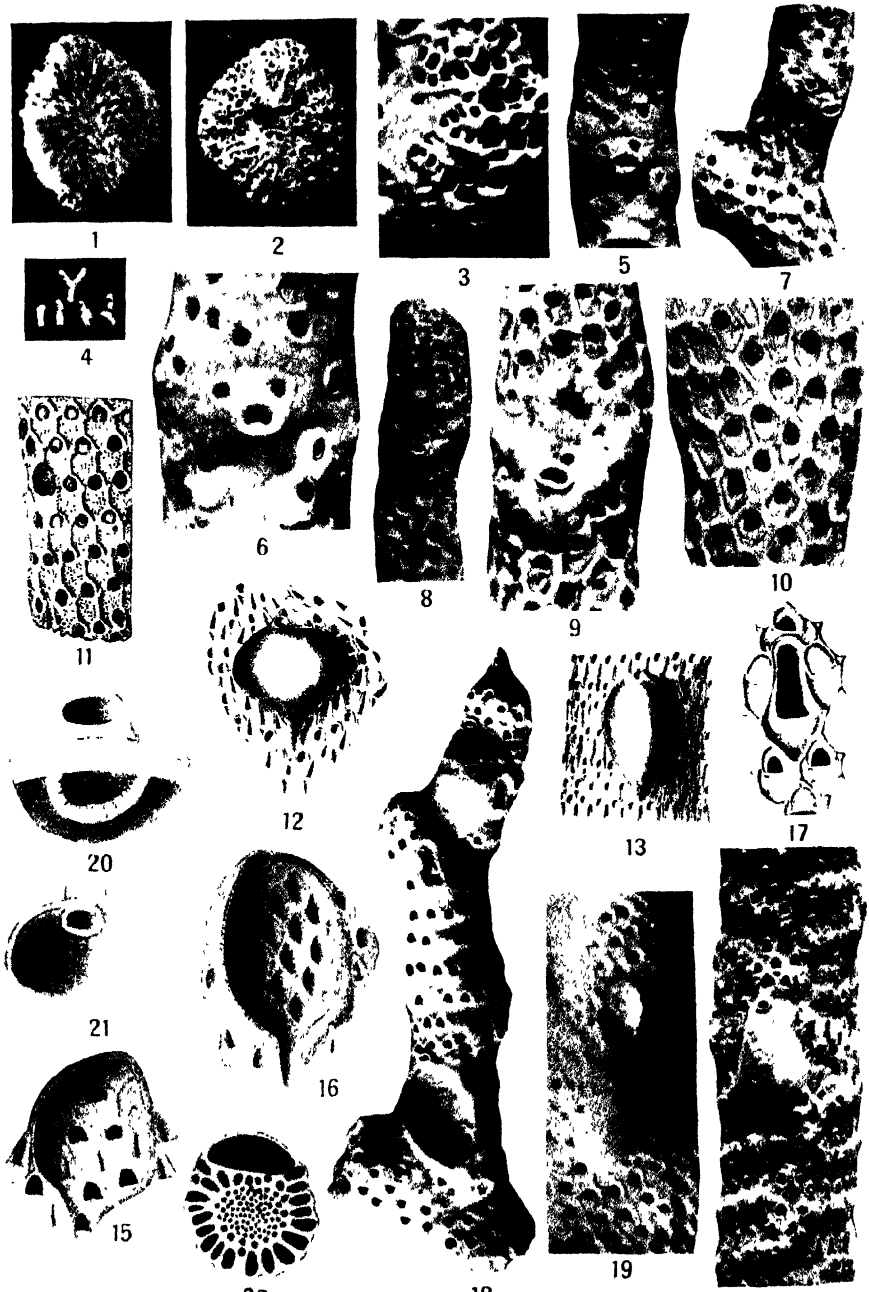
11


14


12

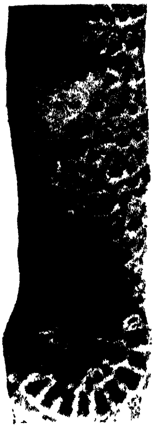
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGE 145.



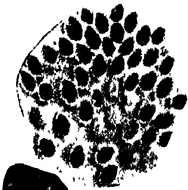
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

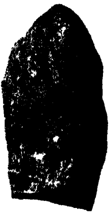
FOR EXPLANATION OF PLATE SEE PAGES 145-146.

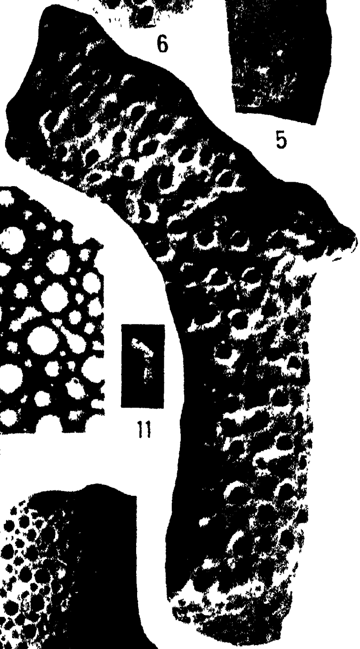

3

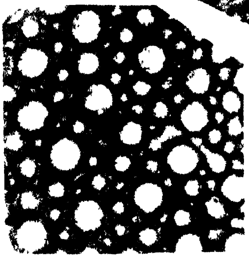
7

13

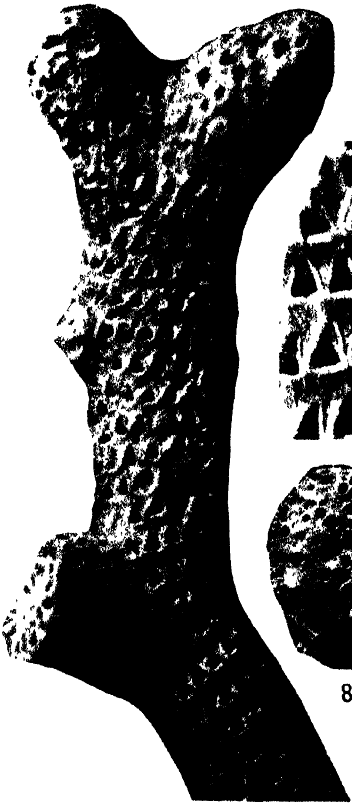

6

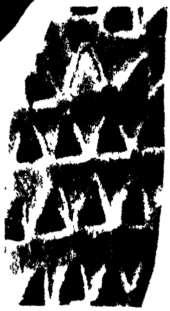

5

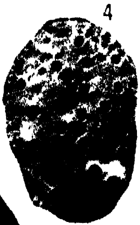

12


9

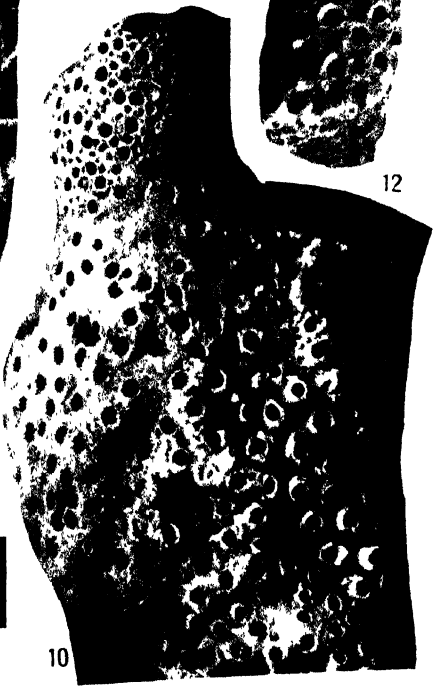
11


1


4

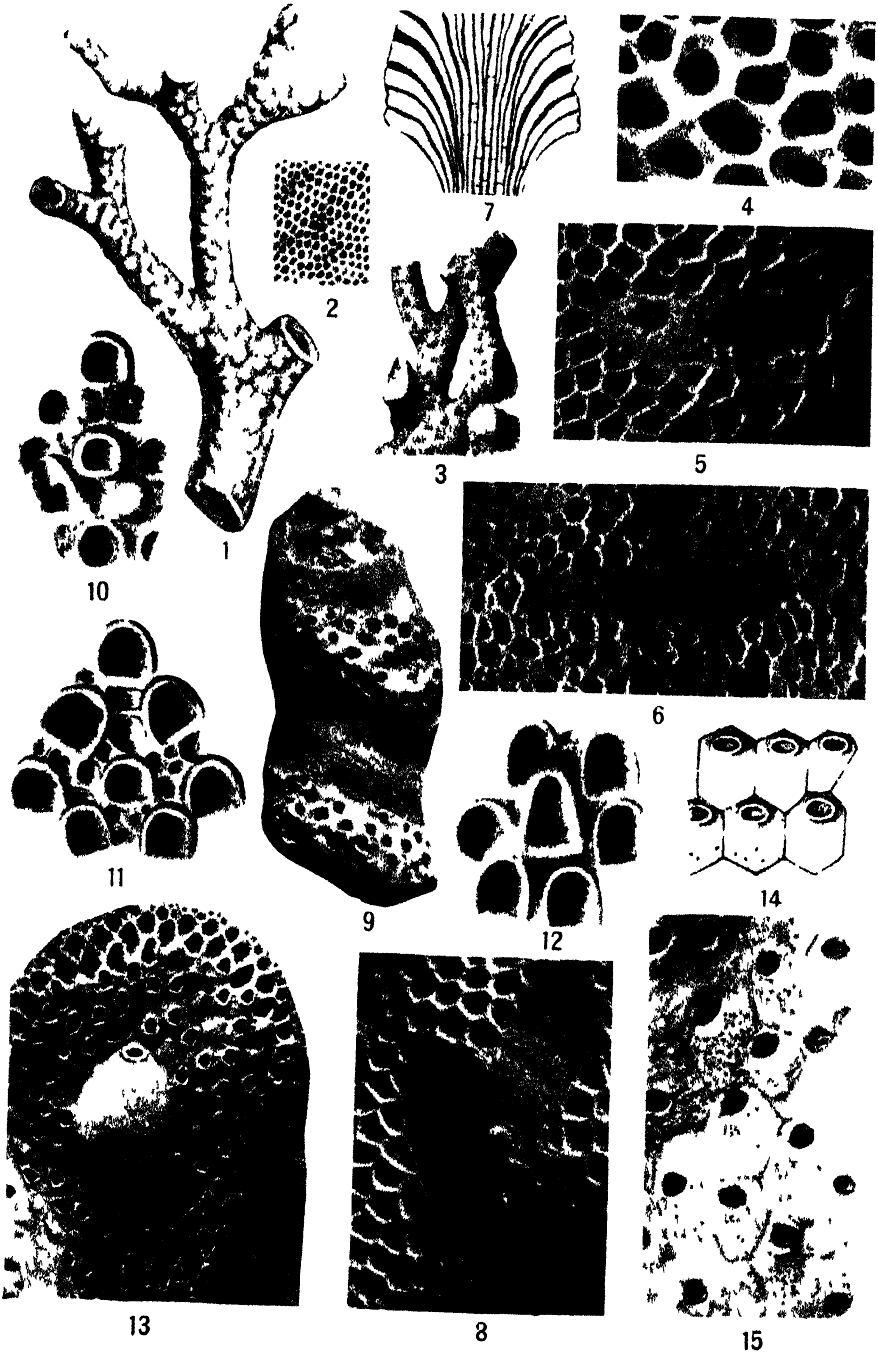

8

2


10

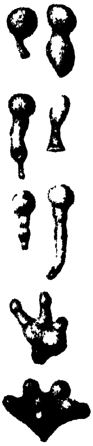
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGE 146

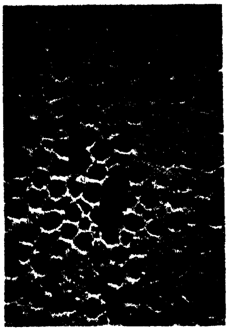


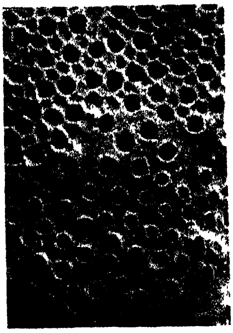
Fossil and Recent Cyclostomatous Bryozoa.

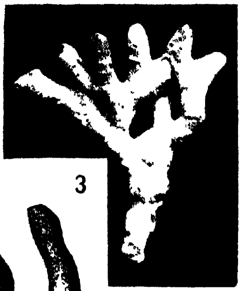
For explanation of plate see pages 146-147

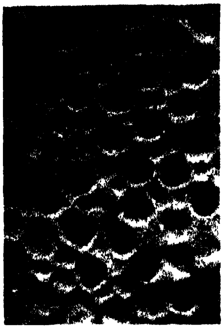

1

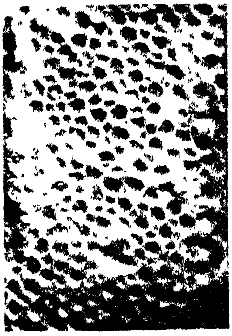
4

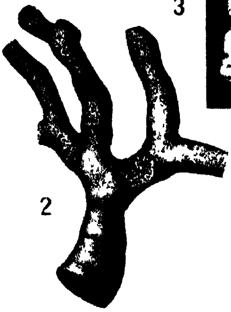

5

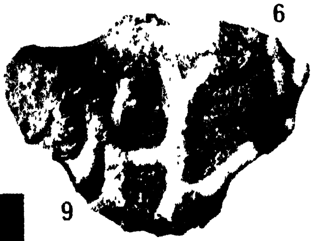

7

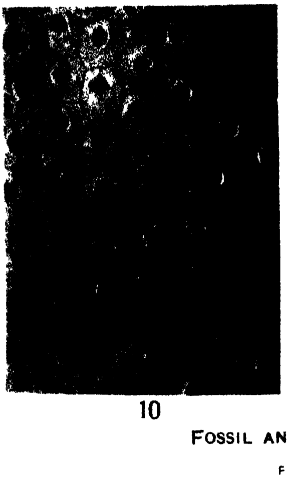

3

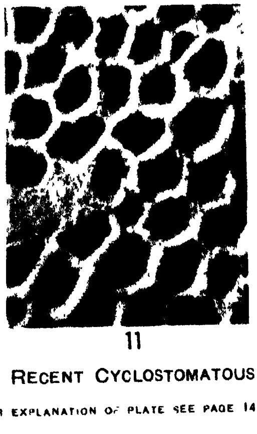

6

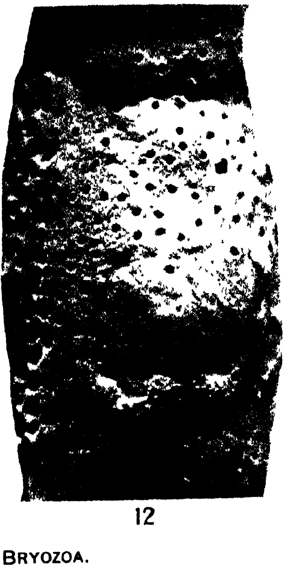

8


2


9

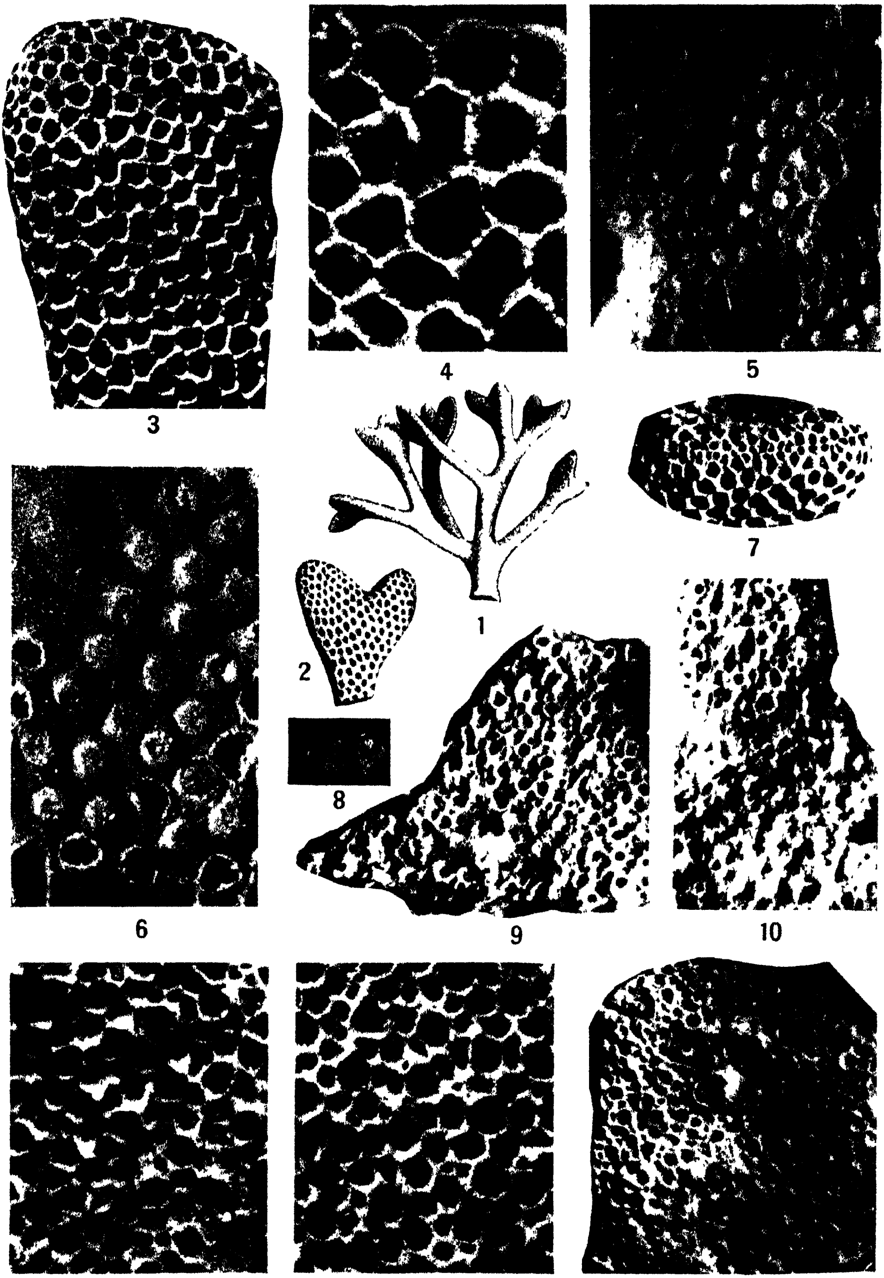

10


11


12

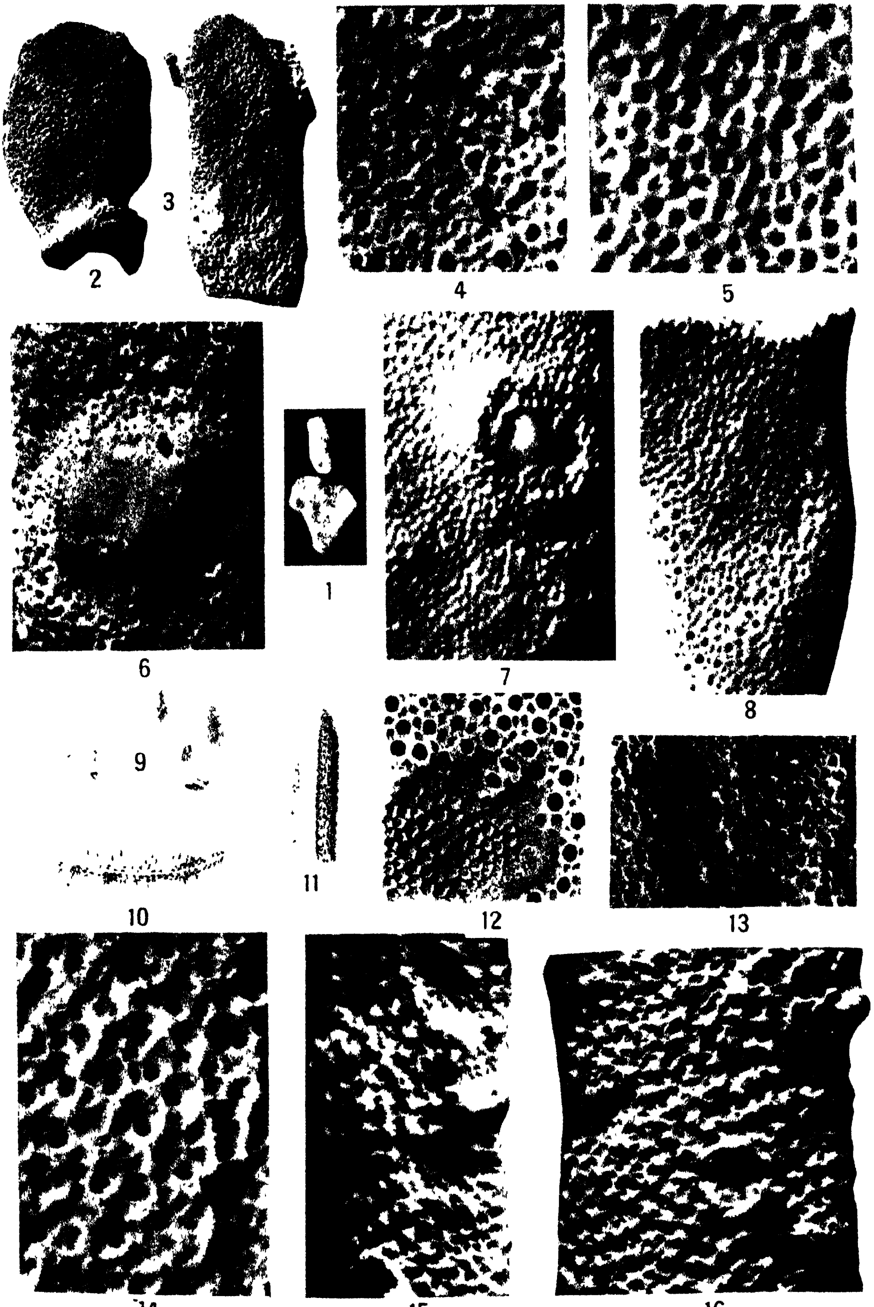
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGE 147



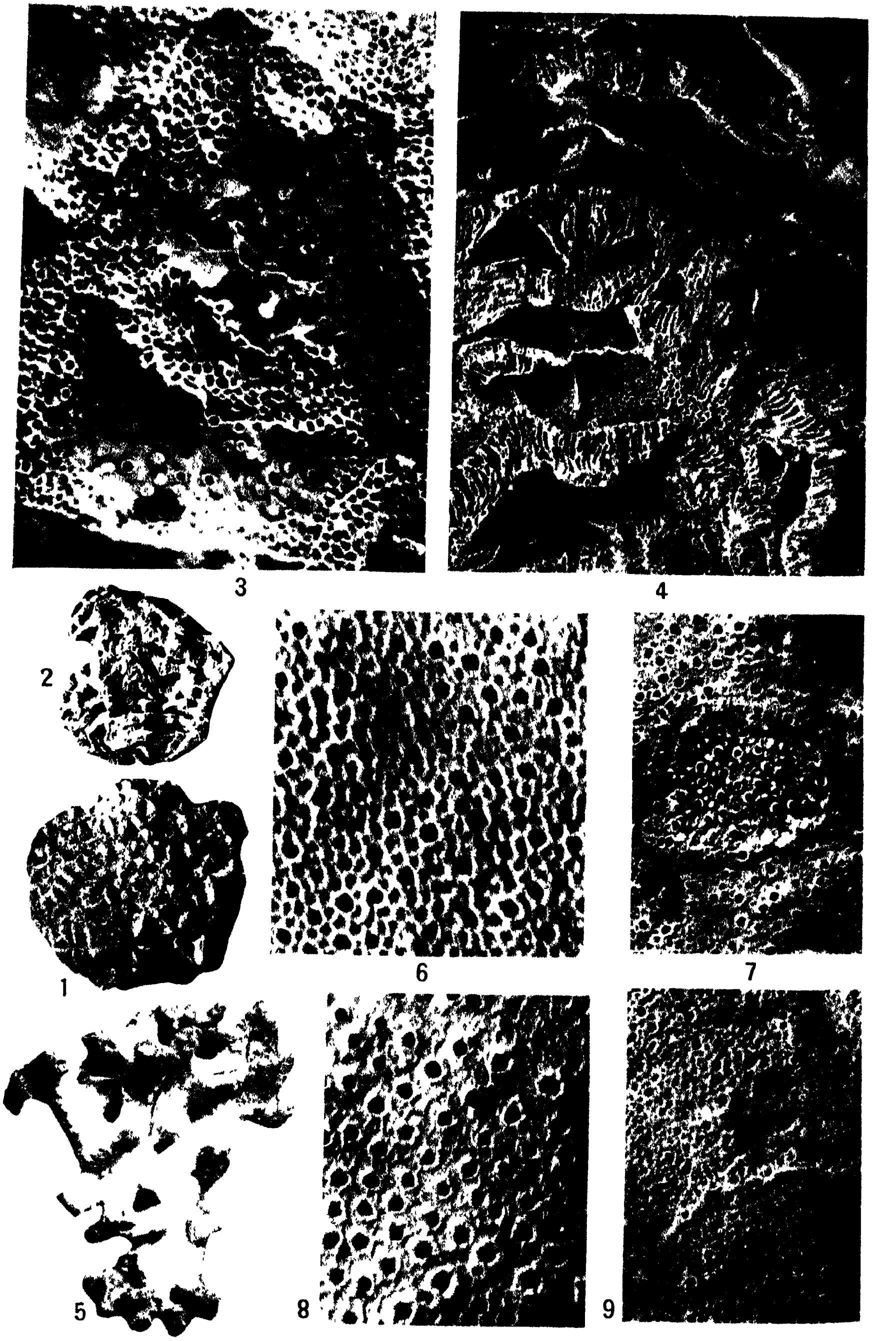
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 147-148.



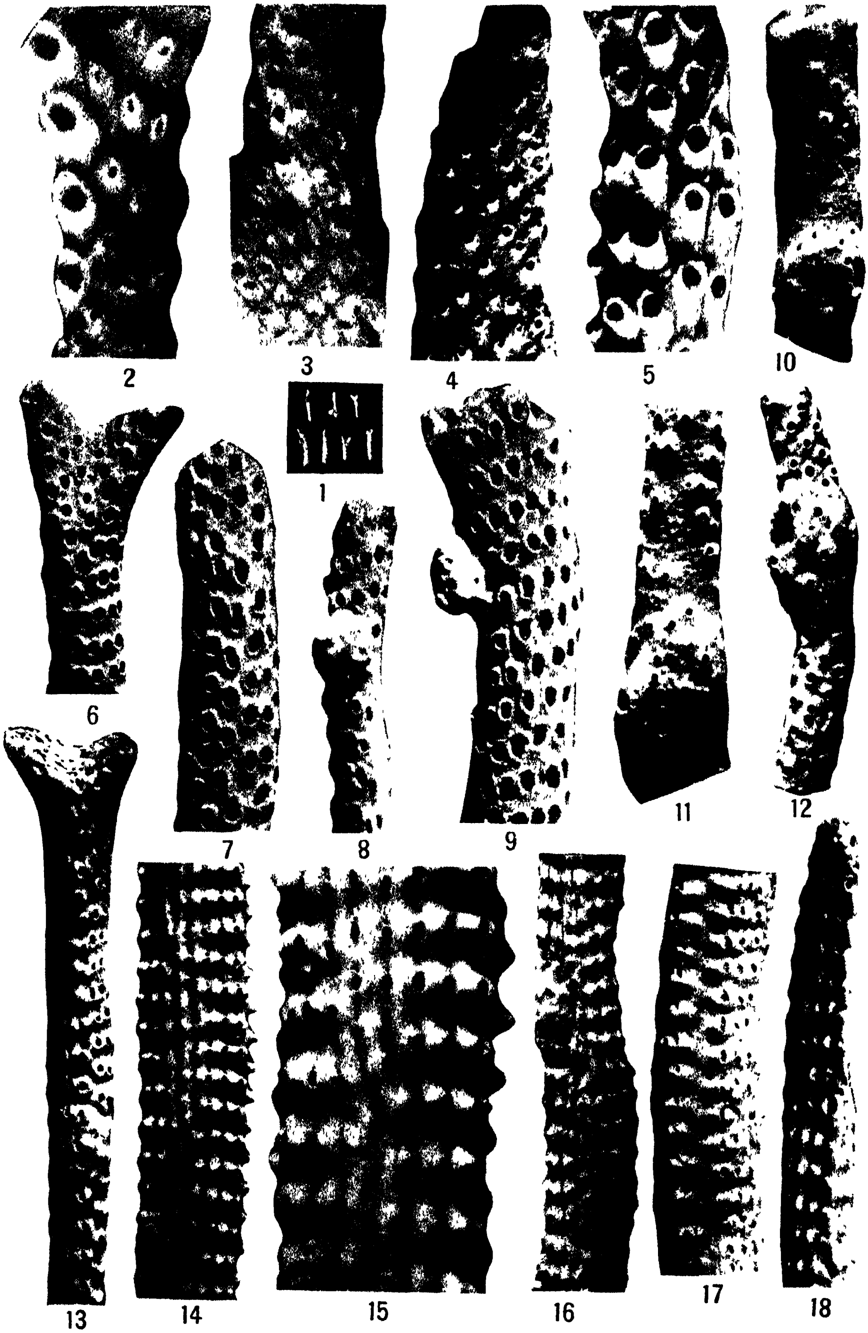
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGE 148.



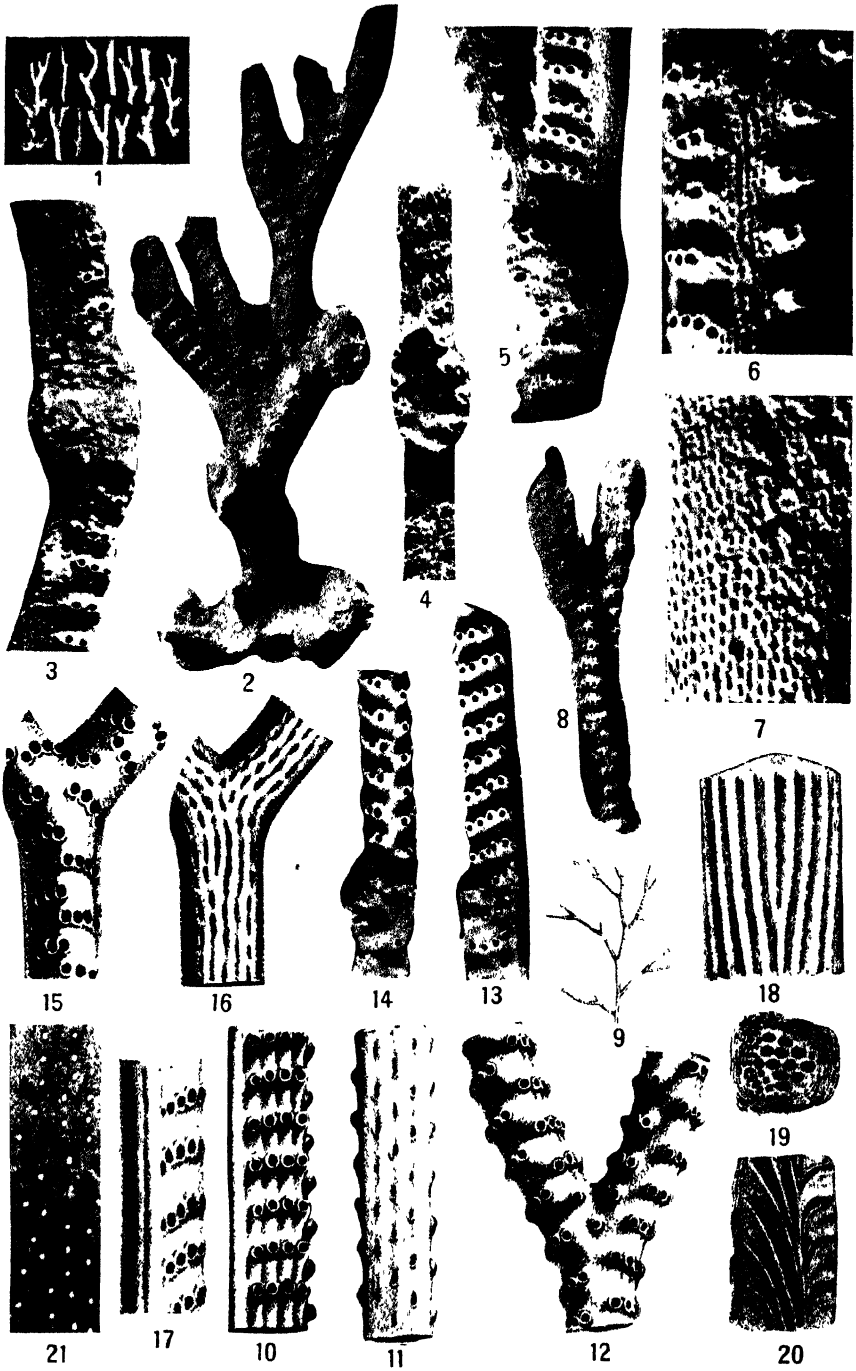
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

FOR EXPLANATION OF PLATE SEE PAGES 148-149



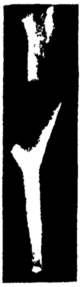
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

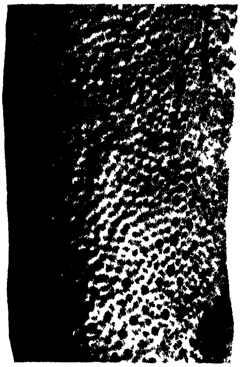
FOR EXPLANATION OF PLATE SEE PAGE 149



FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

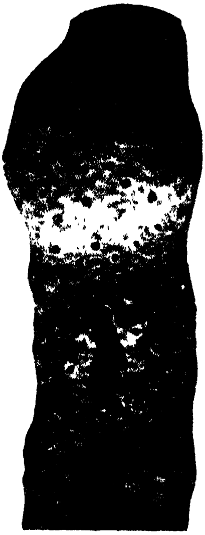
FOR EXPLANATION OF PLATE SEE PAGES 149-150


1


3

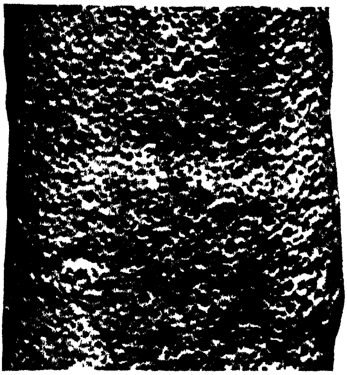
2

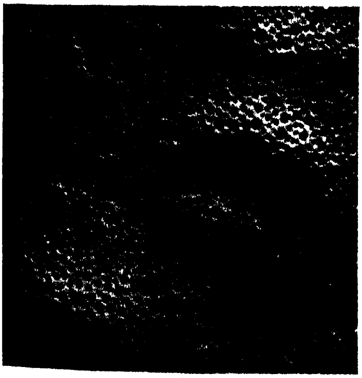
4

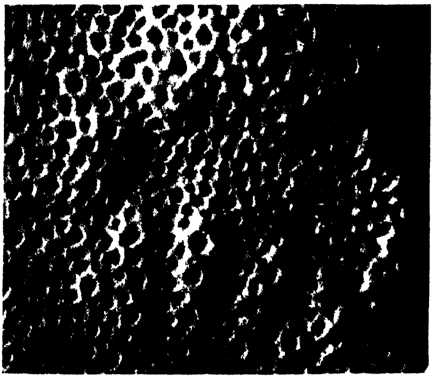

8

7

6

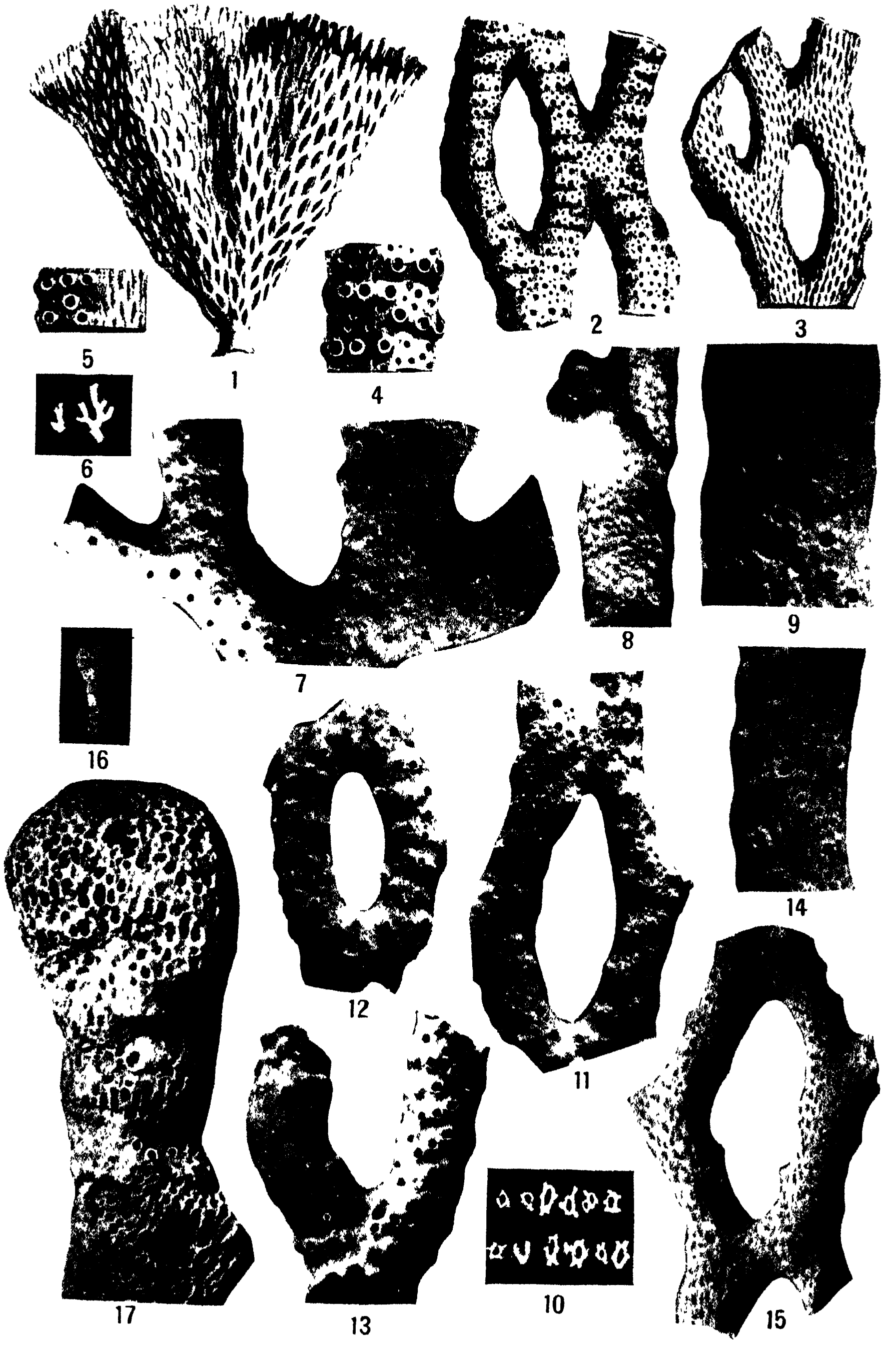

5


9


10

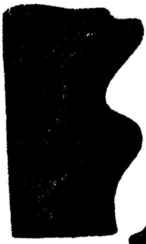
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

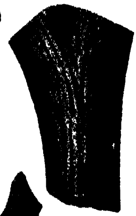
FOR EXPLANATION OF PLATE SEE PAGE 150.

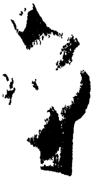


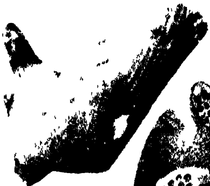
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

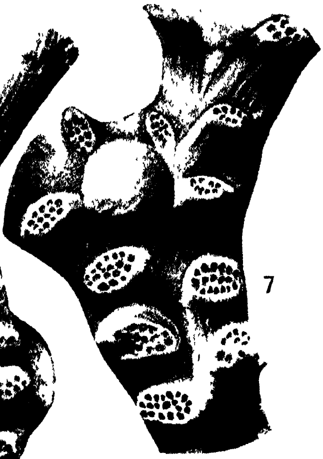
FOR EXPLANATION OF PLATE SEE PAGES 160-161


3

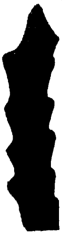

5

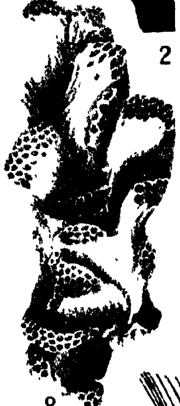

4

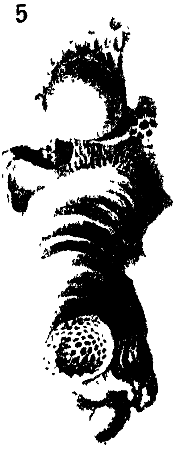

6

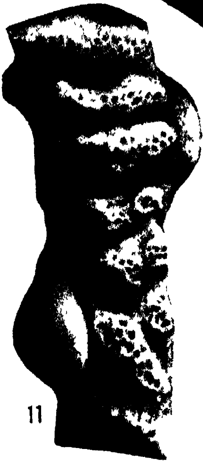

7

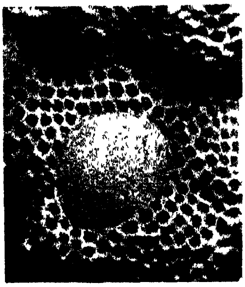
1

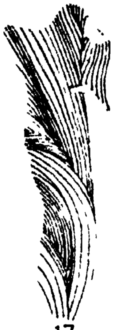

2

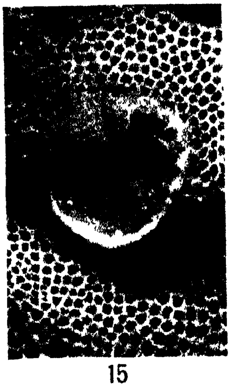

8

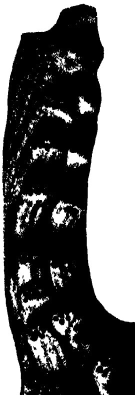

9

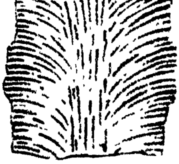

11

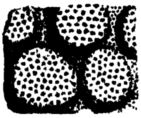

16

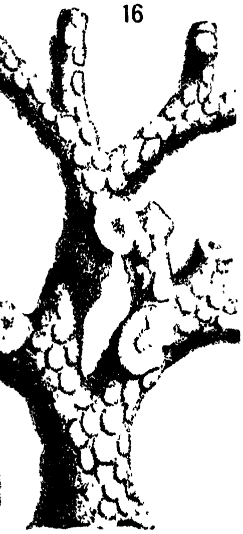

17


15


10

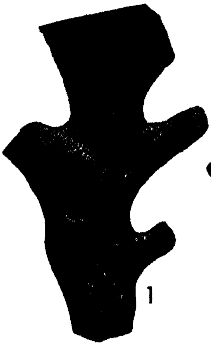

14


13

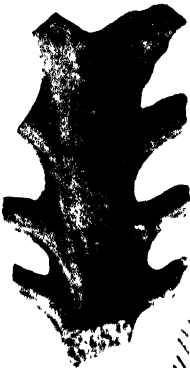

12

Fossil and Recent Cyclostomatous Bryozoa.

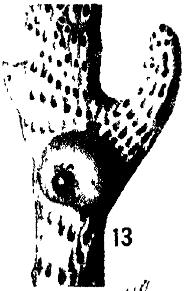
For explanation of plate see page 161


1

2

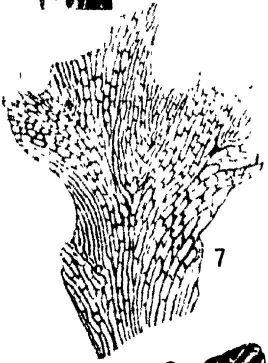

3

8


13

6

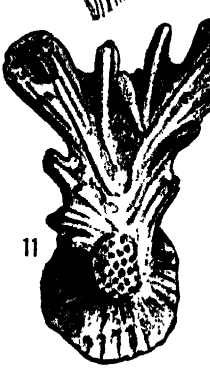
4


7

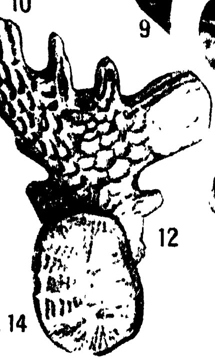
10

9

5

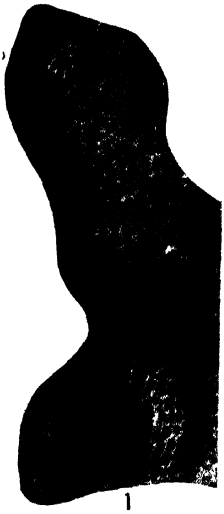

11

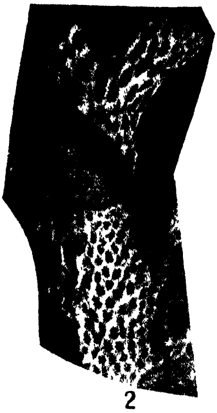
14

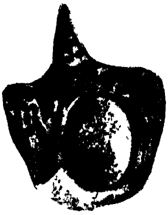

12

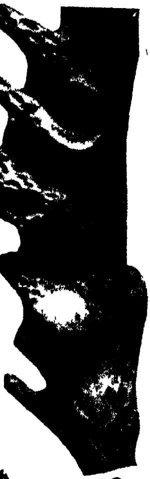
FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.

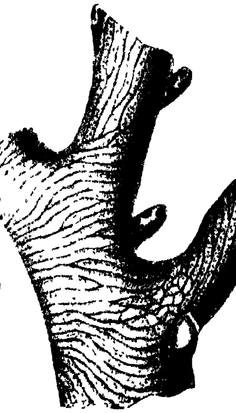
FOR EXPLANATION OF PLATE SEE PAGE 152.

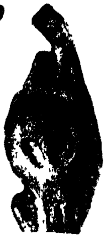

1

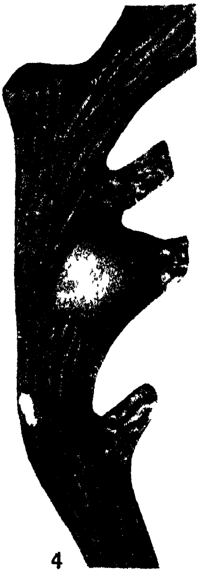

2

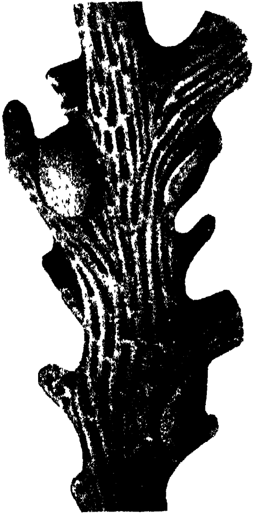

6

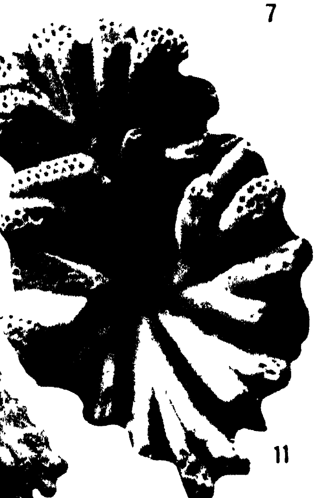

3

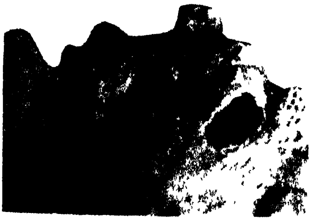

8

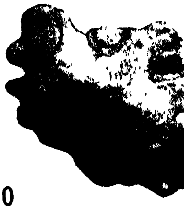

7


4


5

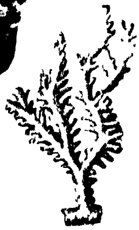

11

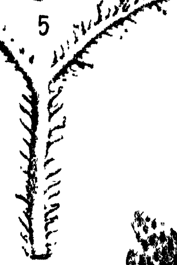

10

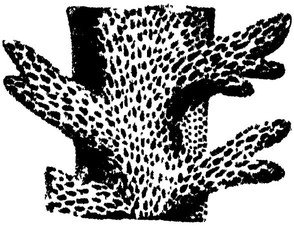

9

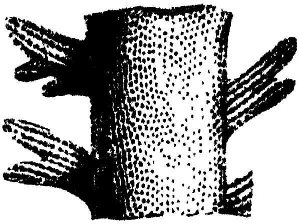
Fossil and Recent Cyclostomatous Bryozoa.

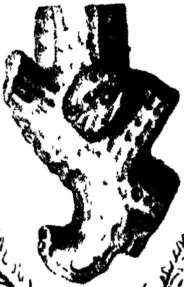
For explanation of plate see page 162.

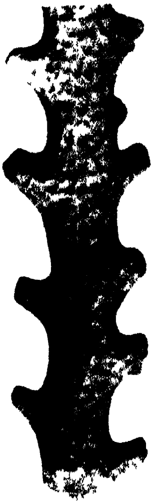

1

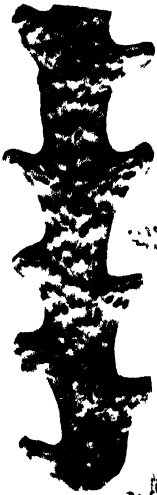

2

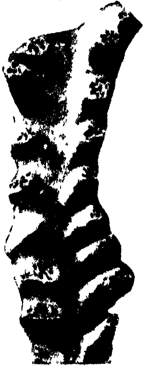

3

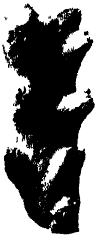

4

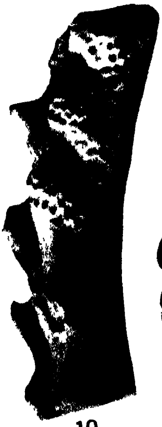

5

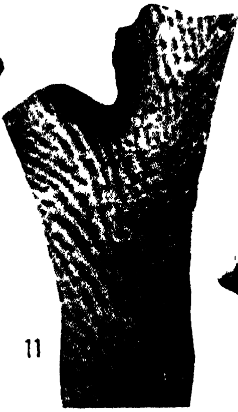

6


7

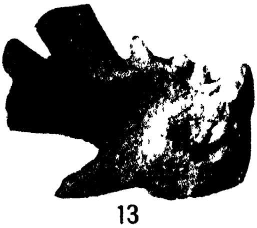

8

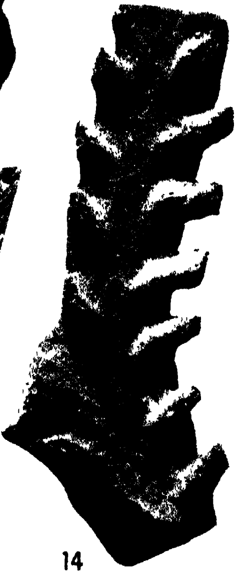

9

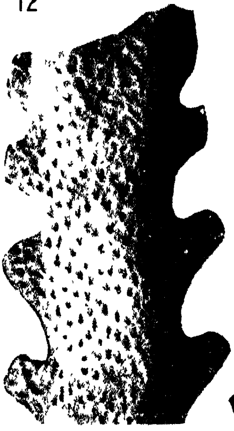

10

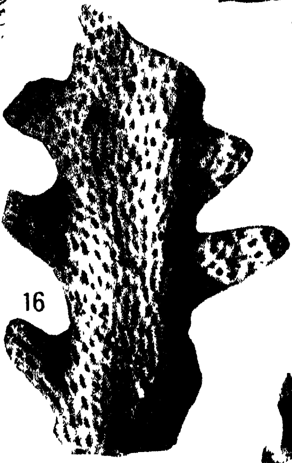

11

12

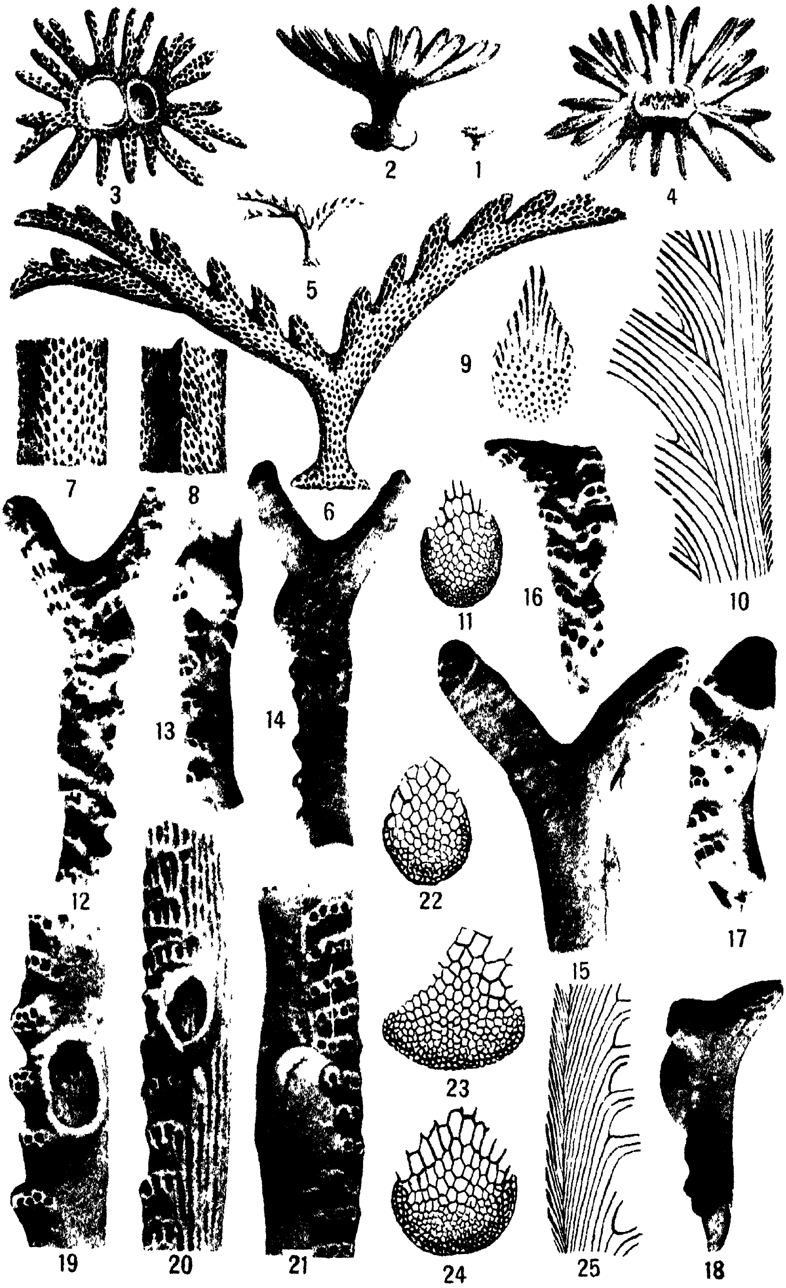

13


14


15

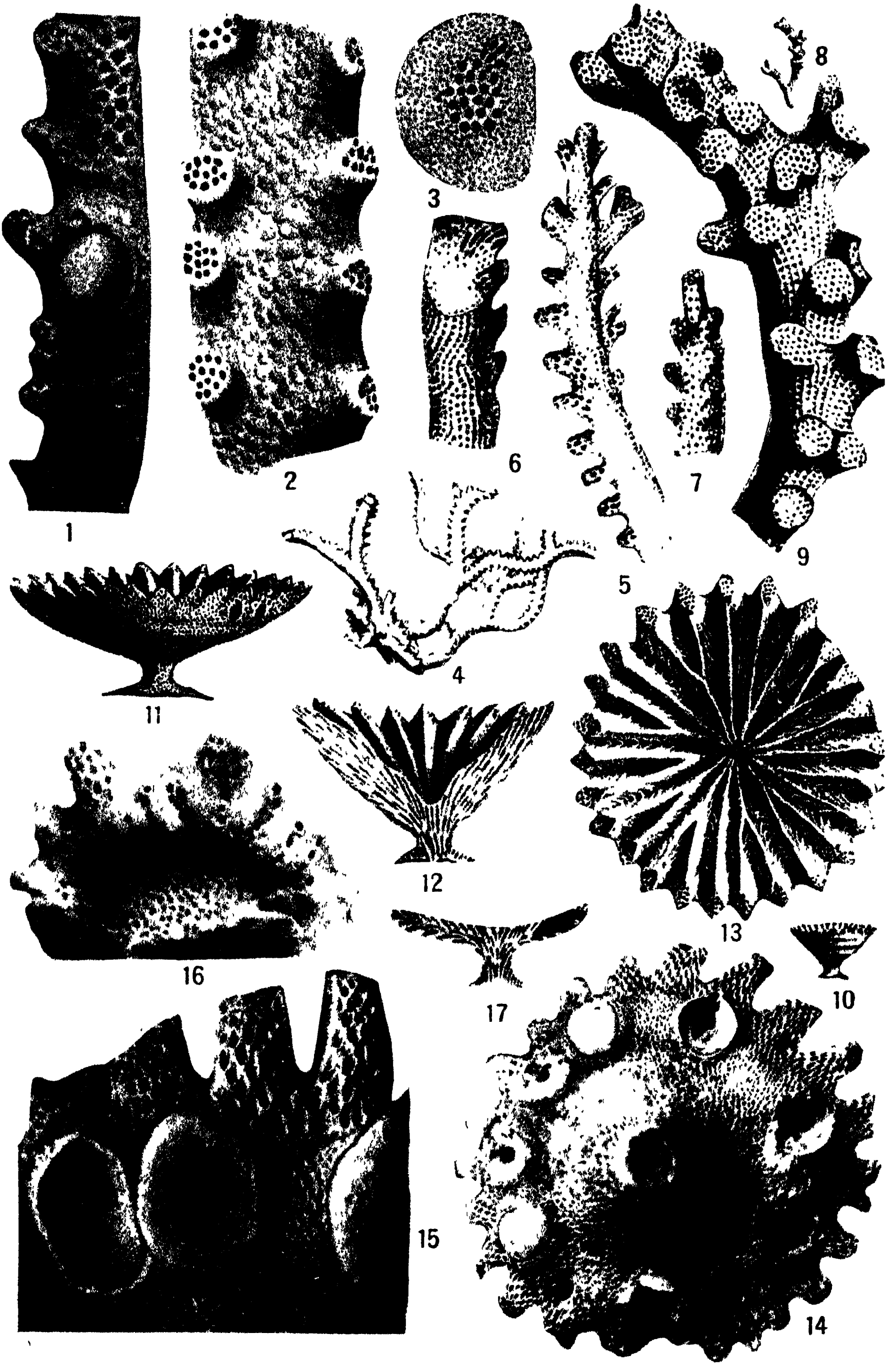

16

FOSSIL AND RECENT CYCLOSTOMATOUS BRYOZOA.



Fossil and Recent Cyclostomatous Bryozoa.

For explanation of plate see pages 153-154



Fossil and Recent Cyclostomatous Bryozoa.

For explanation of plate see page 154.

INDEX OF SCIENTIFIC NAMES.

[Synonyms are in italics.]

Page.
accumulata, Oncousoecia 6, 7, 139
Actinopora 4
aculeata, Idmonea 64
Truncatula 61, 62, 64
alternata, Diplodesmepora 60, 153
Alveolaria 4, 108, 110
semiovata 111, 148
americana, Berenicea 27
americana, Diaperoecia? 46, 144
Plagioecia 27, 141
angulosa, Meliceritites 84, 146
annulata, Notoplagioecia 31
annulata, Semilaterotubigera 31
annulosa, Entalophora 16
annulosa, Mecynoecia (?) 16, 140
annulosa, Spiropora 16
anomalopora, Ceriopora 101
anomalopora, Ditaxia 101, 102, 148
anomalopora, Ditaxia 103
antiqua, Bisidmonea 23
antiqua, Bisidmonea 24
Apsendesia 8
Ascosoecia 4, 113
Ascosoeciidae 4, 113
aspera, Foricula 86
aspera, Meliceritites 86, 147
Atractosoecia 2, 9
edwardsi 8, 10, 141
walfordiana 10, 141
Berenicea americana 27
echinata 42
edwardsi 10
grandis 42
papillosa 42
polystoma 41
sarniensis 21
Bidiastopora neocomiensis 19, 20
bifurcata, Filisparsa 6
bifurcata, Oncousoecia 6, 139
Bisidmonea 2, 11, 23
antiqua 23
Bisidmonea antiqua 24
gabbiana 39
Bisidmonea ? globuloecia 25, 140
Bisidmonea johnstrupi 40
Bisidmonea tetragona 24, 25, 140
blackmorei, Desmepora 77
Brachysoecia 2, 11, 22
convexa 22, 23, 140
burdigalensis, Lichenopora 80, 145
canaliculata, Polyascosoecia 124
cancellata, Idmonea 128
cancellata, Polyascosoecia 125, 126, 128
cancellata, Retecava 125
Retepora 128

Page.
capitiferax, Psilosolen 111, 146
Cardioecia 2, 11, 19
neocomiensis 19, 141
carinata, Hornera 68
Truncatula 62
carinata, Truncatula 68
carinatus, Homoeosolen 68
Cartecytis 3
Cavaria 3, 32
pustulosa 32, 33, 142
ramosa 135
Cavarinella 4, 135
ramosa 135, 149
Cea 3, 36, 37
compressa 37, 142
lamellosa 37, 142
obliqua 37
rhomboidalis 37
rustica 37, 142
subcompressa 37, 142
tuberculata 37
velata 37
Cea (Filicea) regularis 36, 37, 143
(Semicea) lamellosa 37
tubulosa 37, 142
Ceidae 34
Cellepora escharoides 87
polystoma 41
cenomana, Laterotubigera 14
Centronea 3, 48
Ceriocava 4, 90
corymbosa 90, 91, 146
Ceriocavidae 4, 89
Ceriopora anomalopora 101
compressa 28
constantii 99
dichotoma 119
dumetosa 96
gracilis 82, 83
spiralis 92
tetragona 24
verticillata 13
Chilopora 4, 98, 105
cretacea 106, 107, 148
guernoni 105, 106, 148
cicatrix, Parascosoecia 114
cicatrix, Sparsicavea 114
clava, Heteropora 114
clypeiformis, Discosparsa 28
clypeiformis, Plagioecia 28, 140
Coelocochlea 4
Coelophyma granulatum 127
collardeti, Reteporidea 132, 150
compressa, Cea 37, 142
compressa, Ceriopora 28

Page.

- compressa, Diaperoecia 45, 143
- *compressa, Diastopora* 28
  - *Mesenteripora* 28
- compressa, Plagioecia 28, 141
- *conifera, Heteropora* 94
  - *Millepora* 94
- conifera, Ripisoecia 94, 95, 147
- Conocava 4
- *constantii, Ceriopora* 99
  - *Heteropora* 99
- constantii, Leiosoecia 99
- contorta, Grammanotosoecia 123, 150
- *contorta, Idmonea* 52
- contorta, Tennysonia 52
- convexa, Brachysoecia 22, 23, 140
- coronopus, Polyascosoecia 124, 125, 149
- Corymbopora 5
- Corymboporidae 5
- corymbosa, Ceriocava 90, 91, 146
- *corymbosa, Millepora* 90
- Crassohornera 3
- cretacea, Chilopora 106, 107, 148
- *cretacea, Idmonea* 116
  - *Retecava* 118
- Crisia 2
- Crisidia 2
- *Crisidmonea* 116
  - *macropora* 116
- Crisiidae 2
- Crisina 4, 113, 116
- *Crisina ligeriensis* 118
- Crisina normanian 116, 117, 118, 150
  - subgradata 116
  - triangularis 116, 118, 150
- *Crisina (Retecrisina) obliqua* 29
- cristata, Sulcocava 133, 134, 135, 149
- Crisulipora 3
- Cyclocites 4, 88
  - primogenitum 88, 89, 147
- Cyrtopora 3, 53, 54
  - elegans 54, 55
- Cytisidae 3, 52
- *delicatula, Entalophora* 11
- delicatula, Mecynoecia 11
- denisi, Microecia 21, 140
- Desmediaperoecia 3
- Desmeplagioecia 3
- Desmepora 3, 53, 77
  - blackmorei 77
  - pinnigera 77
  - reussi 77, 154
  - rugosa 78, 79
  - semicylindrica 77, 78, 154
- Diaperoecia 3, 41
  - ? americana 46, 144
  - compressa 45, 143
  - distans 45, 143
  - laxipora 43
  - papillosa 42, 143
  - polystoma 41, 143
  - punctata 44, 143
  - saillans 43, 143
  - transversata 44, 143
  - turonica 42, 143
- Diaperoeciidae 3, 41

Page.

- *Diastopora compressa* 28
  - *lamellosa* 8
  - *lineata* 47
  - *michelini* 18
  - *papillosa* 42
  - *verrucosa* 18
- *dichotoma, Ceriopora* 119
- dichotoma, Grammascosoecia 119, 120
- *dichotoma, Heteropora* 99, 108, 119, 120
  - *Sparsicavea* 120
- dichotoma, Tretocycloecia 108, 109
- digitata, Supercytis 72, 73, 153
- Diplodesmepora 3, 58, 59
  - alternata 60, 153
  - opposita 59, 60, 153
- Diplosolen 3, 46
  - entalophoridea 47, 144
  - lineatum 47, 144
- Discocytis 3, 53, 70
  - eccentrica 72, 154
  - essenensis 154
  - eudesi 70, 71, 154
- Discofascigera 3
- discoidea, Truncatula 69, 152
- *Discosparsa clypeiformis* 28
  - *varians* 26
- *disparilis, Homoeosolen* 75
- disparilis, Semicytis 74, 75, 152
- distans, Diaperoecia 45, 143
- *distans, Escharites* 45
- Ditaxia 4, 98, 101
  - anomalopora 101, 102, 148
- *Ditaxia anomalopora* 103
- Ditaxia parvipora 103, 104, 148
- divagans, Plagioecia 27, 144
- *dumetosa, Ceriopora* 96
- dumetosa, Grammecava 96, 147
- *dumetosa, Millepora* 96
- eccentrica, Discocytis? 72, 154
- *echinata, Berenicea* 42
  - *Pustulipora* 14
- edwardsi, Atractosoecia 8, 10, 141
- *edwardsi, Berenicea* 10
- *Elea lamellosa* 85
- *Elea reticulata* 20
- elegans, Cyrtopora 54, 55
- Eleidae 4, 81
- Entalophora 2
- *Entalophora annulosa* 16
  - *delicatula* 11
  - *longipora* 13
  - *ramosissima* 14
  - *vendinnensis* 14, 15
- Entalophora (Nematifera?) roemeri 20, 146
- entalophoridea, Diplosolen 47, 144
- Erkosonea 3, 48
- *Escharites distans* 45
- *escharoides, Cellepora* 87
- escharoides, Semimultelea 87, 146
- essenensis, Discocytis 154
- eudesi, Discocytis 70, 71, 154
- *eudesi, Pelagia* 70, 71
- Exochoecia 2
- falcata, Unicytis 73, 153

Page.
farrinigdonensis, Notoplagioecia 29, 30, 139
Fasciculipora 3
fenestrata, Homoeosolen 76
fenestrata, Pleuronea 50, 144
    Semicytis 76, 153
Filicea 36
Filicea subcompressa 37
Filicrisina 4, 113, 136
    retiformis 137
    verticillata 136, 137, 149
Filisparsa 2
Filisparsa bifurcata 6
filix, Osculipora 64
filix, Truncatula 63, 64, 152
flabellata, Stathmepora 39
flexuosa, Laterotubigera 31
flexuosa, Notoplagioecia 31, 141
foraminosa, Polyascosoecia 124, 125
Foricula aspera 86
    spinosa 87
francqana, Parascosecia 115, 149
francqana, Sparsicavca 115
Frondipora 3
gabbiana, Bisidmonea 39
gabbiana, Stathmepora 39, 40, 143
gamblei, Homoesolen 62, 152
globuloecia, Bisidmonea? 25, 140
gracilis, Ceriopora 82, 83
gracilis, Mecynoecia 12, 141
    Meliceritites 82, 83, 146
gracilis, Meliceritites 20
gracilis, Truncatula 68
Grammanotosoecia 4, 123
    contorta 123, 150
Grammascosoecia 4, 113, 119
    dichotoma 119, 120
    parvipora 122, 150
    porosa 121, 122, 150
Grammecava 4, 95
    dumetosa 96, 147
grandis, Berenicea 42
granulatum, Coelophyma 127
guernoni, Chilopora 105, 106, 148
Haplooecia 4, 97
    straminea 97, 98, 147
Hemicellaria ramosa 131
    royana 129
Heteropora clava 114
    conifera 94
    constantii 99
    dichotoma 99, 108, 110, 120
    obliqua 114
    parvicella 100
    pelliculata 110
    pustulosa 108
    tenera 119
    undulata 119
hirsuta, Platonea 49, 145
Homoeosolen 3, 53, 61
Homoeosolen carinatus 68
    disparilis 75
    fenestrata 76
Homoeosolen gamblei 62, 152
Homoeosolen pinnatus 64
Homoeosolen ramulosus 61, 152
Homoeosolen striatus 68
    tetragonus 66
Hornera 3
Hornera carinata 68
    langethali 137
    ramosa 131
Horneridae 3
houzeaui, Osculipora 57, 151
Idmidronea 3, 48
Idmonea 3, 48
Idmonea aculeata 64
    cancellata 128
    contorta 52
    cretacea 116
    lichenoides 127
Idmonea magna 50, 143
Idmonea pinnata 64
    prima 116
    semicylindrica 77
    tetragona 66
imbricata, Polyascosoecia 124
irregularis, Phormopora 137
jacksonica, Polyascosoecia 124
johnstrupi, Bisidmonea 40
johnstrupi, Stathmepora 40, 142
Lagonoecia 3
lamellosa, Cea 37, 142
    Cea (Semicea) 37
lamellosa, Diastopora 3
    Elea 85
lamellosa, Macroecia 3, 9
    Meliceritites 85, 147
langethali, Hornera 137
Laterocavea 4
Laterocea 3, 36, 38
    simplex 38, 143
Laterotubigera cenomana 14
    flexuosa 31
    micropora 16
laxata, Multicrescis 120
laxipora, Diaperoecia 43
laxipora, Mesenteripora 43
Leiosoecia 4, 98, 99
    constantii 99
    occlusa 100, 151
    parvicella 99, 100
Leiosoeciidae 4, 98
Lekythionia 3
lichenoides, Idmonea 127
    Polyascosoecia 125, 127
    Retecava 127
    Retepora 127
Lichenopora 4, 80
    burdigalensis 80, 145
Lichenoporidae 4, 80
ligeriensis, Crisina 118
lineata, Diastopora 47
lineatum, Diplosolen 47, 144
Lobosoecia 4, 81
    semiclausa 81, 145
Lobosoeciidae 4, 80
lobulata, Tubulipora 5
longipora, Entalophora 13
longipora, Mecynoecia 13, 139
Lopholepis 4

Page.

- Macroecia 2, 8
  - lamellosa 8, 9
- Macroeciidae 2, 7
- *macropora, Crisidmonea* 116
- magna, Idmonea 50, 152
- magnifica, Meliceritites 85, 86, 146
- *magnifica, Multelea* 85
- magnipora, Notoplagioecia 30, 141
- malmi, Plethopora 151
- marssoni, Parascosoecia 115, 149
- Mecynoecia 2, 11
  - (?) annulosa 16, 140
  - delicatula 11
  - gracilis 12, 141
  - longipora 13, 139
  - micropora 16, 140
  - obesa 12, 139
  - ramosissima 14, 139
  - stipata 15, 139
  - variabilis 17, 140
  - (?) verticillata 13, 139
- Mecynoeciidae 2, 11
- Meliceritites 4, 82
  - angulosa 84, 146
  - aspera 86, 147
  - gracilis 82, 83, 146
- *Meliceritites gracilis* 20
- Meliceritites lamellosa 85, 147
  - magnifica 85, 86, 146
- *Meliceritites pyrenaica* 86
  - *semicalusa* 81
- Meliceritites spinosa 87
- *Mesenteripora compressa* 28
  - *laxipora* 43
  - *michelini* 17
- Mesonea 3, 48
- *michelini, Diastopora* 18
  - *Mesenteripora* 17
- michelini, Trigonoecia 18, 140
- Microecia 2, 11, 21
  - denisi 21, 140
- *micropora, Laterotubigera* 16
- micropora, Mecynoecia 16, 140
- *micropora, Spiropora* 16
- *Millepora conifera* 94
  - *corymbosa* 90
  - *dumetosa* 96
- *Multelea magnifica* 85
- *Multicrescis laxata* 120
  - *parvicella* 100
- Multifascigera 4
- Multitubigera 4
- Nematifera 2, 11, 20
  - reticulata 20, 141
  - (?) roemeri 20
- *neocomiensis, Bidiastopora* 19, 20
- neocomiensis, Cardioecia 19, 141
- normaniana, Crisina 116, 117, 118, 150
- Notoplagioecia 3, 29
  - annulata 31
  - farringdonensis 29, 30, 139
  - flexuosa 31, 141
  - magnipora 30, 141
- obesa, Mecynoecia 12, 139
- obliqua, Cea 37

Page.

- *obliqua, Crisina (Retecrisina)* 29
- *obliqua, Heteropora* 114
- obliqua, Plagioecia 29, 142
- *obliqua, Reticulipora* 29
- occlusa, Leiosoecia 100, 151
- Oncousoecia 2, 5
  - accumulata 6, 7, 139
  - bifurcata 6, 139
- Oncousoeciidae 2, 5
- opposita, Diplodesmepora 59, 60, 153
- Orosopora 4
- Osculipora 3, 53, 56
- *Osculipora filiæ* 64
- Osculipora houzeaui 57, 151
  - repens 57, 58, 151
  - royana 57, 58, 151
- *Osculipora rugosa* 79
- Osculipora truncata 57, 151
- *papillosa, Berenicea* 42
- papillosa, Diaperoecia 42, 143
- *papillosa, Diastopora* 42
- Parallelata 1, 2, 5
- Parascosoecia 4, 113, 114
  - cicatrix 114
  - francqana 115, 149
  - marssoni 115, 149
- Parleiosoecia 4, 98
- Partretocycloecia 4, 108
- *parvicella, Heteropora* 100
- parvicella, Leiosoecia 99, 100
- *parvicella, Multicrescis* 100
- parvipora, Ditaxia 103, 104, 148
  - Grammascosoecia 122, 150
- patina, Plagioecia 26
- *patina, Tubulipora* 26
- *Pelagia eudesi* 70, 71
- *pelliculata, Heteropora* 110
- pelliculata, Tretocycloecia 110, 146
- *Peripora pseudospiralis* 114
- Peristomoecia 2
- Phormopora 3
- *Phormopora irregularis* 137
- *pinnata, Idmonea* 64
- pinnata, Truncatula 64, 65, 152
- *pinnatus, Homoeosolen* 64
- pinnigera, Desmepora 77
- Plagioecia 3, 26
  - americana 27, 141
  - clypeiformis 28, 140
  - compressa 28, 141
  - divagans 27, 144
  - obliqua 29, 142
  - patina 26
  - varians 26, 141
- Plagioeciidae 3, 26
- Platonea 3, 48, 49
  - hirsuta 49, 145
  - scalaria 49, 145
- plebeia, Truncatula 152
- Plethopora 3, 53, 55
  - malmi 151
- *Plethopora ramulosa* 56
- Plethopora verrucosa 55
- Plethoporella 3, 53, 56
  - ramulosa 56, 151

Page.

- Pleuronea 3, 48
  - fenestrata 50, 144
- Polyascosoecia 4, 113, 124
  - canaliculata 124
  - cancellata 125, 126, 128
  - coronopus 124, 125, 126, 149
  - foraminosa 124
  - imbricata 124
  - jacksonica 124
  - lichenoides 125, 127
  - punctata 125
  - sparsa 124
- *polystoma, Berenicea* 41
  - *Cellepora* 41
- polystoma, Diaperoecia 41, 143
- porosa, Grammascosoecia 121, 122, 150
- *prima, Idmonea* 116
- primogenitum, Cyclocites 88, 89, 147
- *procera, Spiroclausa* 137
- Prosthenoecia 3
- *pseudospiralis, Peripora* 114
- Psilosolen 4, 108, 112
  - capitiferax 111, 146
- punctata, Diaperoecia 44, 143
  - Polyascosoecia 125
- punctatus, Stigmatoechos 48, 144
- *Pustulopora echinata* 14
  - *variabilis* 17
- pustulosa, Cavaria 32, 33, 142
- *pustulosa, Heteropora* 108
- *pyrenaica, Meliceritites* 86
- Radiofascigera 4
- *ramosa, Cavaria* 135
- ramosa, Cavarinella 135, 149
- *ramosa, Hemicellaria* 131
  - *Hornera* 131
- ramosa, Reteporidea 130, 131
- *ramosissima, Entalophora* 14
- ramosissima, Mecynoecia 14, 139
  - Terebellaria 34, 144
- *ramulosa, Plethopora* 56
- ramulosa, Plethoporella 56, 151
- ramulosus, Homoeosolen 61, 152
- Rectangulata 1, 4, 80
- regularis, Cea (Filicea) 36, 37, 143
- repens, Osculipora 57, 58, 151
- *repens, Truncatula* 57
- *Retecava cancellata* 128
  - *cretacea* 118
  - *lichenoides* 127
- Retenoa 3
- *Retepora cancellata* 128
  - *lichenoides* 127
  - *truncata* 57
- Reteporidea 4, 113, 129
  - collardeti 132, 150
  - ramosa 130, 131
  - royana 129, 130, 150
  - subramosa 132, 150
- *reticulata, Elea* 20
- reticulata, Nematifera 20, 141
- *Reticulipora obliqua* 29
- retiformis, Filicrisina 137
- reussi, Desmepora 77, 154
- rhomboidalis, Cea 37

Page.

- Ripisoecia 4, 94
  - conifera 94, 95, 147
- roemeri, Entalophora (Nematifera ?) 20, 146
  - Nematifera ? 20
- *royana, Hemicellaria* 129
- royana, Osculipora 57, 58, 151
  - Reteporidea 129, 130, 150
- rugosa, Desmepora 78, 79
- *rugosa, Osculipora* 79
  - *Semicytis* 79
- rustica, Cea 37, 142
- sabaudica, Tretocycloecia 110, 148
- saillans, Diaperoecia 43, 143
- *sarniensis Berenicea* 21
- scalaria, Platonea 49, 145
- Semicea 36
- semiclausa, Lobosoecia 81, 145
- *semiclausa, Meliceritites* 81
- semicylindrica, Desmepora 77, 78, 154
- *semicylindrica, Idmonea* 77
- Semicytis 3, 53, 74
  - disparilis 74, 75, 152
  - fenestrata 76, 153
- *Semicytis rugosa* 79
- *Semilaterotubigera annulata* 31
- Semimultelea escharoides 87, 146
- semiovata, Alveolaria 111, 148
- Serietubigera 4
- simplex, Laterocea 38, 143
- Siphodictyum 4
- sparsa, Polyascosoecia 124
- *Sparsicavea cicatrix* 114
  - *dichotoma* 120
  - *francqana* 115
  - *undulata* 120
- *spinosa, Foricula* 87
- spinosa, Meliceritites 87
- *spiralis, Ceriopora* 92
- spiralis, Spiroclausa 92, 93, 147
- *spiralis, Zonopora* 92
- Spiroclausa 4, 92
- *Spiroclausa procera* 137
- Spiroclausa spiralis 92, 93, 147
- *Spiropora annulosa* 16
  - *micropora* 16
  - *tetragona* 24
  - *verticillata* 13
- Stathmepora 3, 39
  - flabellata 39
  - gabbiana 39, 40, 143
  - johnstrupi 40, 142
- stellata, Tennysonia 51, 145
- Stigmatoechos 3, 48
  - punctatus 48, 144
- stipata, Mecynoecia 15, 139
- straminea, Haplooecia 97, 98, 147
- *striatus, Homoeosolen* 68
- subcompressa, Cea 37
- *subcompressa, Filicea* 37
- subgradata, Crisina 116
- subpinnata, Truncatula 66, 67, 152
- subramosa, Reteporidea 132, 150
- Sulcocava 4, 113, 133
  - cristata 133, 134, 135, 149

Page.

Supercytis 3, 72
  digitata 72, 73, 153
Telopora 4, 108
tenera, Heteropora 119
Tennysonia 3, 48, 50
  contorta 52
  stellata 51, 145
Terebellaria 3, 34
  ramosissima 34, 144
Tervia 3
Terviidae 3
tetragona, Bisidmonea 24, 25, 140
tetragona, Ceriopora 24
  Idmonea 66
  Spiropora 24
  Truncatula 62
tetragona, Truncatula 66, 67, 153
tetragonus, Homoeosolen 66
Theonoa 4
Theonoidae 4
transversa, Trigonoecia 19, 141
transversata, Diaperoecia 44, 143
Tretocycloecia 4, 108
  dichotoma 108, 109
  pelliculata 110, 146
  sabaudica 110, 148
Tretocycloeciidae 4, 108
Tretonea 3, 48
triangularis, Crisina 116, 118, 150
Trigonoecia 2, 11, 17
  michelini 18, 140
  transversa 19, 141
  verrucosa 18, 141
Trochiliopora 4
truncata, Osculipora 57, 151
truncata, Retepora 57
Truncatula 4, 53, 63
Truncatula aculeata 61, 62, 64
  carinata 62

Page.

Truncatula carinata 68
  discoidea 69, 152
  filix 63, 64, 152
  gracilis 68
  pinnata 64, 65, 152
  plebeia 152
Truncatula repens 57
Truncatula subpinnata 66, 67, 152
Truncatula tetragona 62
Truncatula tetragona 66, 67, 153
  vendocinensis 69, 70, 153
tuberculata, Cea 37
Tubulipora 3, 48
Tubulipora lobulata 5
  patina 26
Tubuliporidae 3, 48
tubulosa, Cea (Semicea) 37, 142
turonica, Diaperoecia 42, 143
undulata, Heteropora 119
  Sparsicavea 120
Unicytis 3, 53, 73
  falcata 73, 153
variabilis, Mecynoecia 17, 140
variabilis, Pustulopora 17
varians, Discosparsa 26
varians, Plagioecia 26, 141
velata, Cea 37
vendinnensis, Entalophora 14
vendocinensis, Truncatula 69, 70, 153
verrucosa, Diastopora 18
verrucosa, Trigonoecia 18, 141
verticillata, Ceriopora 13
verticillata, Filicrisina 136, 137, 149
  Mecynoecia (?) 13, 139
verticillata, Spiropora 13
walfordiana, Atractosoecia 10, 141
Zonopora spiralis 92

A NEW CECIDOMYIID PARASITE OF THE WHITE FLY.

By E. P. Felt,
State Entomologist, Albany, New York.

The following relates to a species of gall midge or Itonidid which was evidently reared in considerable numbers from the white fly, *Aleurycus chagentios*, since a series of some 25 flies were submitted for determination.

The insect is undescribed and apparently represents a new genus.

CLEODIPLOSIS, new genus.

This genus is erected for a species which would normally fall into the genus *Clinodiplosis* Kieffer were it not for the occurrence of a well-defined tooth upon the claws of all three pairs of legs. The structure of the dorsal and ventral plates and the simple style precludes it being referred to either *Plesiobremia* Kieffer, *Dichodiplosis* Rübsaamen, or *Thomasia* Rübsaamen. The females of the last two genera also have a long ovipositor which is an additional bar to placing this species in either.

The type of the new genus is *Cleodiplosis aleyrodici*, new species.

CLEODIPLOSIS ALEYRODICI, new species.

Male.—Length 1.2 mm. Antennae one-fourth longer than the body, thickly haired, light brown, 14 segments, the fifth having stems with a length 1½ and 1¼ times their diameters respectively; basal enlargement subglobose, with a subdorsal whorl of moderately long, stout setae and near the middle a circumfilum with moderately long, heavy loops, the latter not extending to the base of the pyriform, distal enlargement, which latter has a length about one-fourth greater than its diameter, a distinct constriction near the basal third, basally and apically circumfila, the loops of the distal filum extending to the base of the next segment; terminal segment having the basal portion of the stem with a length 5 times its diameter; the distal enlargement distinctly produced, with a length nearly 3 times its greatest diameter, a constriction near the basal third and a broadly obtuse, tapering apex. Palpi; first segment short, irregular, second with a length about 2½ times its diameter, the third as long as the second, more slender, the fourth a little longer than the third; mesonotum dark reddish brown; scutellum and postscutellum fuscous yellowish; abdomen probably yellowish brown; wings hyaline, the third vein uniting with the margin at the apex, the fifth joining the posterior margin at the distal fourth, its branch at the basal third; halteres pale yellowish; coxae and legs pale straw; the claws bent at nearly right angles, minutely unidentate; pulvilli rudimentary. Genitalia; basal clasp segment short, stout; terminal clasp segment short, stout, somewhat curved, and apically distinctly chitinized; dorsal plate rather long, broad, broadly and triangularly emarginate, the lobes broadly triangular and sparsely setose apically; ventral plate long, rather broad, broadly, deeply and roundly emarginate, the lobes rather broad, broadly rounded apically and sparsely setose; style rather short, broad, broadly rounded apically.

Female.—Length 1.5 mm. Antennae about three-fourths the length of the body, sparsely haired, yellowish brown, 14 segments, the fifth with a stem about one-fifth the length of the cylindrical basal enlargement, which latter has a length about 2¼ times its diameter; terminal segment somewhat produced, cylindrical, with a length about 3 times its diameter and apically a short obtuse process. Mesonotum dark reddish brown; scutellum and postscutellum fuscous yellowish; abdomen dark reddish brown; ovipositor short; the terminal lobes suborbicular and apically with a rather thick group of stout setae; coxae and femora mostly pale straw; tibiae and tarsi darker; otherwise nearly as in the male.

Type.—Male, Cat. No. 25211, United States National Museum. Four slides with type and paratypes. One slide paratypes in New York State Museum (Cecid. A3177).

The five slides containing the material described above were received from the United States National Museum in February, 1921, and were labeled Parasites on White Fly, *Aleurycus chagentios*, Panama City, I, Molina, Res., G. 686, December 2, 1919.

DESCRIPTIONS OF MISCELLANEOUS NEW REARED PARASITIC HYMENOPTERA.

By A. B. Gahan,

Of the Branch of Cereal and Forage Crop Insects, United States Bureau of Entomology.

In addition to descriptions of twelve species believed to be new to science and falling in the Hymenopterous superfamilies Ichneumonoidea, Chalcidoidea, and Serphoidea, this paper contains notes on several described species. All of the new species are described from reared specimens, and more or less definite host records are given for each species. Included are notes on three species from India, one from South Africa, one from the Panama Canal Zone, one from Porto Rico, and several from the United States and Canada.

Superfamily ICHNEUMONOIDEA.

Family BRACONIDAE.

ROGAS HYPHANTRIAE, new species.

In general appearance very closely resembles *terminalis* Cresson but is at once distinguished by having the abdomen practically devoid of distinct striae, whole third tergite opaquely sculptured, fourth also opaque for the most part, first abscissa of discoidal vein hardly longer than nervulus, ocelli distant from the eye-margin distinctly more than the greatest diameter of an ocellus, and mesosternum entirely, mesopleura below, and the metapleura finely coriaceous and opaque. Also resembles *harrimani* Ashmead but may be distinguished by the same characters which separate it from *terminalis*.

Female.—Length 6.5 mm. Head finely granularly punctate, the face with a few indistinct transverse rugae; malar space approximately equal to length of scape, malar groove absent; eyes weakly emarginate within; ocelli not large, antennae inserted above the middle of the face, 46-jointed, the third joint about twice as long as thick, all joints of flagellum longer than thick; mesoscutum sculptured like the head, its posterior middle depressed and rugose, parapsidal grooves well developed; scutellum sculptured like mesoscutum; propodeum rugose with a distinct median carina; propleura rugose; mesopleura rugose above, granularly rugulose below with a smooth area at the posterior middle; mesosternum sculptured like the lower part of mesopleura; metapleura finely rugulose; middle and hind coxae granularly punctate, fore coxae polished; first abscissa of radius about equal to first intercubitus, a little shorter than second radial abscissa; abscissa of cubitus between recurrent nervure and first intercubitus only a little shorter than first intercubitus; nervulus postfurcal by a little more than its own length; first abscissa of discoideus not over half the length of second abscissa; abdomen longer than head and thorax, laterally compressed at extreme apex; first, second, and third tergites rather finely rugulose, with scarcely any indications of longitudinal striation, the median longitudinal carina delicate and fading out before attaining apex of third tergite; fourth tergite opaquely sculptured or nearly so, the sculpture similar to that of the third but not quite so strong; tergites beyond the fourth more weakly sculptured and mostly shining; ovipositor sheaths about as long as the exposed part of fourth tergite. Head and thorax black; orbits before and behind, malar space more or less, mandibles, sutures of mesoscutum, axillae, sides of scutellum, place of attachment of wings and a line on mesopleura below middle, fusco-ferruginous; antennae black; tegulae, all legs, and three basal segments of abdomen ferruginous, the hind femora above toward apex and their tibiae somewhat infuscated and the third tergite at apex blackish; tergites beyond the third and ovipositor sheaths black. The female paratype has the fourth tergite ferruginous on basal half.

Male.—Similar to the female in size and sculpture but the head and thorax entirely black, the third tergite black except narrow base and an incomplete median stripe.

Type locality.—Fredericton, New Brunswick, Canada.

Type.—Cat. No. 24971, U.S.N.M.

Host.—*Hyphantria*, species.

Two females and a male reared by A. G. Dustan, September 4, 1917, and bearing his number 11166.

MICROBRACON CAULICOLA, new species.

Resembles *cephi* Gahan but differs by having the antennae usually 29-jointed in the female, the ovipositor distinctly more than half the length of abdomen, and the tergites less strongly sculptured. Differs from *xanthostigma* (Cresson) by the less strongly sculptured tergites, the slightly shorter ovipositor and the nearly uniformly reddish testaceous color. Also resembles *argutator* (Say) but may be distinguished by the less strongly sculptured tergites, the more strongly infumated wings and the absence of any black on head and thorax.

Female.—Length 2.8 mm. Frons and face weakly shagreened, subopaque, remainder of head and thorax polished; antennae 29-jointed in the type; first flagellar joint two and one-half to three times as long as thick, joints near apex about twice as long as thick; propodeum mostly polished, the posterior middle obscurely wrinkled and with a short stub of a median carina at apex; first radial abscissa of forewing equal to less than half the second, third abscissa longer than first and second combined; abdomen about equal in length to the head and thorax, slightly broader than the thorax, long ovate in outline; first tergite smooth anteriorly with a prominent, embossed, faintly rugulose area at apical middle and on each side of this at the posterior lateral angles of the tergite an oblong, depressed, rugulose area set off by carinae and extending approximately from the middle to the posterior margin of the tergite; second and following tergites distinctly though rather weakly and nearly uniformly sculptured, more or less shining, suturiform articulation not angulated at the middle though slightly sinuate, not especially deep, and scarcely at all crenulate; ovipositor exserted very nearly the length of the abdomen. Head, thorax, abdomen, and legs dark reddish testaceous; eyes, antennae, apical joint of all tarsi and ovipositor sheaths black; tips of mandibles, maxillary palpi and hind tibiae at apex usually, slightly infuscated; wings slightly infuscated, the infuscation stronger on basal half; wing veins blackish; stigma brownish-yellow, becoming blackish apically.

Male.—Slightly smaller, but otherwise similar in all respects to the female, except that the antennae of the allotype are 31-jointed.

This species, as shown by the type series, is variable in several respects. The number of antennal joints ranges from 29 to 33, the sculpture of the tergites is slightly heavier in some specimens than in the type, while the length of body ranges from 2 mm. to 3.6 mm. The female paratype from Champaign, Illinois, which is the largest specimen in the type series, has the propodeum and a large part of the mesosternum piceous.

Type locality.—Urbana, Illinois.

Type.—Cat. No. 24982, U.S.N.M.

The type female, five paratype females, and five male paratypes received from D. J. Caffrey, under Accession No. 3305, were reared from *Pyrausta ainsliei* Heinrich, collected at Urbana, Illinois, July 10, 1919, by W. P. Flint. The allotype male is from the same host collected at Champaign, Illinois, by C. W. Knapp, November 25, 1916, and bears Accession No. 6638–J. A male and a female paratype bear the same data, except the date November 21, 1919, and the Accession No. 2297–B. Also four females and three males reared from a larva believed to have been *Pyrausta ainsliei*, boring the stem of *Polygonum*, sp., and received from E. M. Searls, Schenectady, New York.

Five specimens of what appears to be the same species were reared at Ipswich, Massachusetts, July 21, 1921, from *Pyrausta nubilalis* by H. L. Parker. Also fifteen specimens reared by G. G. Ainslie at Knoxville, Tennessee, in July, 1919, from *Pyrausta penitalis* are apparently the same species. The two series last mentioned are not considered a part of the type material.

MICROBRACON PAPAIPEMAE, new species.

This species resembles *furtivus* Fyles but is readily distinguished by the weaker sculpture on the abdominal tergites and the generally darker color.

Female.—Length 3.2 mm. Head transverse; vertex, cheeks, posterior orbits, and occiput smooth and polished; frons and face uniformly finely coriaceous; antennae 27-jointed, in the type the first flagellar joint slightly the longest, hardly twice as long as thick; following joints all distinctly longer than thick; mesoscutum and scutellum polished, sparsely hairy; propodeum polished, with three to four short upward directed and divergent striae on each side of the apical middle; pleura smooth and polished; abdomen about as long as head and thorax, a little broader than thorax at its widest point; first tergite not quite as broad as long, the sides nearly parallel, slightly constricted at base, the embossed apical portion as well as the posterior lateral margins rugulosely sculptured; suturiform articulation moderately deep and straight, not angulated at the middle; second tergite rather strongly sculptured with a few indistinct longitudinal rugae on each side of the middle, the anterior middle with a very small embossed area; tergites beyond second all weakly sculptured and more or less shining; ovipositor exserted approximately the length of the whole body; stigma of forewing broad, lanceolate-ovate; first abscissa of radius slightly shorter than the breadth of stigma; second abscissa fully twice as long as first and distinctly longer than the first intercubitus; radial cell terminating somewhat in front of the extreme wing apex. General color shining black; frons and more or less of the vertex piceous or brownish; face, malar space, and lower part of cheeks testaceous; antennae entirely brownish black; thorax mostly black; scutellar region and pleura more or less piceous; legs including all coxae reddish testaceous; hind tibiae and tarsi piceous black, the base of tibiae testaceous; abdomen black dorsally; lateral margins of first segment, margins of second, and the suture separating second and third tergites pale testaceous; abdominal venter and the ovipositor sheaths brownish testaceous; wings subhyaline, the venation dark brown.

Male.—Unknown.

Type locality.—Rye, New York.

Type.—Cat. No. 24983, U.S.N.M.

Host.—*Papaipema frigida* Smith.

Described from four female specimens received from Mr. Henry Bird and reared by him October 26, 1917, from the above named host.

Family ICHNEUMONIDAE.

GELIS MICROPLITIDIS, new species.

This species in general appearance is very similar to a Viereck homotype of *pettiti* Cresson, but differs in having narrower posterior orbits, a distinctly shorter prothorax and mesoscutum, a distinctly set off scutellum, and the posterior thoracic lobe is more convex, with a complete transverse carina.

Female.—Length 3 mm. Apterous; head transverse, viewed from above, approximately twice as broad as long; posterior orbits rounded and about equal to half the eye width; postocellar line a little longer than ocellocular line; whole head with the usual pezomachine sculpture; antennae rather short, 19-jointed; thorax sculptured like the head but a little more strongly so; mesoscutum rather short, not much longer than broad, the posterior lateral angles sharply produced into a small tubercule; scutellum small, distinctly separated from the mesoscutum by a shallow depression; posterior thoracic lobe strongly convex, viewed from the sides very abruptly declivous anteriorly, more sloping posteriorly, the posterior face with a distinct complete transverse carina which is rather strongly angled medially; abdomen distinctly longer than head and thorax; first tergite fully twice as broad at apex as at base, about as long as posterior thoracic lobe, its spiracle not prominent, sculptured like the thorax; abdomen beyond the first tergite broadly ovate, shining, the sculpture much weaker than that of the first tergite, sparsely hairy, the hairs short; ovipositor exserted nearly one and one-half times the length of the first tergite. General color very dark reddish brown; antennae dark reddish testaceous, brownish apically; abdominal petiole and all trochanters pale testaceous.

Male.—Winged; head shaped and sculptured as in female; postocellar line equal to about twice the ocellocular line; antennae 23-jointed; thorax sculptured like the head; mesoscutum without parapsidal grooves on the posterior two-thirds; propodeum areolated, the carinae, except the posterior transverse carina, very faint and delicate, the areola hexagonal and about as broad as long; discocubital vein with or without a ramellus; radial cell rather short; the metacarpus about equal in length to the anterior margin of stigma; areolet open, pentagonal in position; abdomen about as long as head and thorax; first tergite slender, about one and one-half times as broad at apex as at base, opaquely sculptured with a few indistinct longitudinal rugae; second tergite sculptured like the first, those beyond the second more weakly sculptured; abdominal pubescence rather dense. General color dark reddish brown; propodeum and abdominal tergites beyond the third black or blackish; antennae, except four or five basal joints, dark brown; base of antennae, legs, including all coxae, and three basal segments of abdomen paler than the thorax, reddish testaceous; wings very slightly infuscated, stigma dark brown, with a pale spot at the inner angle, veins pale brownish.

Type locality.—Rye, New York.

Type.—Cat. No. 24984, U.S.N.M.

Described from two females and three males received from Mr. Henry Bird and reared by him from the cocoons of *Microplitis gortynae* Riley parasitizing *Papaipema nebris* Guenée. Also three female specimens from the same collector reared September 1, 1917, as secondary parasites of *Papaipema marginidens* Guenée.

Superfamily CHALCIDOIDEA.

Family CALLIMOMIDAE.

PODAGRION CRASSICLAVA, new species.

Plate 1, figs. 4 and 5.

This species agrees with the generic description of *Pachytomoidella* Girault except that the female club is not solid but more or less distinctly 3-jointed. Differs from *Podagrion mantis* Ashmead in having the antennal club in the female greatly swollen, as long or nearly as the entire funicle, the joints of the funicle short, the first and second subquadrate, third very slightly transverse, those beyond the third distinctly transverse and increasing in thickness toward the club; scutellum and mesoscutum distinctly less deeply sculptured than in *mantis*. The male differs from the male of *mantis* in having all of the funicle joints subequal and subquadrate, the mesoscutum and scutellum less strongly sculptured, the antennae and the hind femora entirely pale testaceous, and the hind coxae except the basal two-thirds above, pale testaceous.

Female.—Length 1.9 mm. Antennal club three-jointed, the sutures shallow and not very distinct; antennal ring-joint about half as long as broad; pedicel longer than ring-joint and joint one of funicle combined; head strongly sculptured; pronotum and mesoscutum a little less strongly sculptured than head; mesoscutellum similarly, but much more shallowly sculptured, its surface distinctly shining; hind coxae smooth, except outer face, which is distinctly shagreened; hind femora also weakly shagreened with six to ten (seven in the type) strong teeth ventrally; abdomen as long as thorax; ovipositor exerted, approximately the length of the whole insect. Color of head and thorax dark green with only a faint bronzy tinge; antennal club black; remainder of antenna, fore tibiae and tarsi, median legs, except coxae, hind trochanters, tibiae, and tarsi, and the tegulae reddish testaceous; front coxae and femora, middle coxae, and hind coxae and femora more or less brownish black; the outer surface of hind coxae and femora strongly metallic green; teeth on femora black; abdomen mostly blackish with strong metallic luster in some lights; ovipositor reddish, its sheaths black; wings hyaline, venation brownish testaceous.

The color of the legs is quite variable, one paratype having the front and median pairs, except the front coxae, entirely testaceous at base, and the fore and median femora vary from testaceous to mostly brownish black.

Male.—Length 1.9 mm. Antennal club not greatly swollen, only slightly thicker than the cylindriform funicle, and not longer than three apical joints of funicle combined, 3-jointed but the sutures very indistinct; abdomen not nearly as long as thorax; hind basitarsus swollen and as long as the other joints combined; hind femora with four to five strong ventral teeth; otherwise agrees with description of the female except that the antennal club, fore and middle legs entirely, and the hind femora, as well as the apex and ventral side of the hind coxae are testaceous, and the abdomen brownish testaceous.

Type locality.—Brownsville, Texas.

Type.—Cat. No. 24985, U.S.N.M.

Host.—Eggs of *Mantis*, species.

Nine females and three males reared by R. A. Vickery of the Bureau of Entomology, from the egg mass of an undetermined mantid. Antenna from allotype male and one from a paratype female mounted in balsam. Specimens on card points.

Family EURYTOMIDAE.

Genus HARMOLITA.

Phillips and Emery[1] have restricted this genus (formerly known as *Isosoma*) to species having a noncarinate occiput and without umbilicate punctures on the head and thorax.

Since the publication of Phillips and Emery's paper at least two species have come under the present writer's observation which, while apparently agreeing closely in all other essential characters with typical *Harmolita*, and seemingly having similar phytophagous habits, are excluded from the genus because of the fact that in each species a few poorly defined and obscurely umbilicate punctures occur on the mesonotum. In the opinion of the writer these species are more closely related to *Harmolita* than to any other genus of the Eurytomidae and such differences as exist are not believed sufficient to justify the erection of a new genus for their reception. The whole family Eurytomidae is much in need of a thorough revision. and until such a revision is published it is deemed best to place the following described species (as well as the other mentioned above which is described elsewhere[2]) in the genus *Harmolita* even though perhaps slightly extralimital in some characters.

---

[1] Proc. U. S. Nat. Mus., vol. 55, 1919, p. 435.

The genus as recognized by the writer is characterized by having in the female an elongate, conical or subfusiform, subpetiolate abdomen which is weakly or not at all compressed laterally and in which the segments are more or less subequal, the fourth segment never greatly enlarged as in *Eurytoma*. The head as seen from above is transverse, convexly rounded in front, the occiput slightly concave, and immargined; viewed from in front the head is usually somewhat broader than high, truncate below, and not strongly convex above, the cheeks rounded; antennae inserted at or above the middle of face, placed close together at base; the scrobes moderately deep and narrow with the lateral margins rounded; scape not long, more or less compressed; flagellum weakly clavate; pedicel longer than broad; two small ring joints; funicle usually five-jointed and the club 3-jointed, but in some cases the funicle appears to be 6-jointed and the club 2-jointed; pronotum large, the dorsal portion however, broader than long, frequently somewhat broader than the mesoscutum, its anterior dorsal margin rounded; mesoscutum strongly trilobed; scutellum large, longer than broad and rounded at apex; propodeum not or scarcely longer than the scutellum, not sharply declivous, usually rugosely sculptured with a more or less distinct median longitudinal depression; legs normal; wings usually ample (absent in some cases) the marginal vein distinctly longer than the postmarginal which is variable; stigmal subequal to or distinctly shorter than the postmarginal. Sculpture of head and dorsum of thorax either reticulate and shining, rugulose punctate without umbilicate punctures, or rugulose with a few more or less indefinite umbilicate punctures.

The male abdomen is subcylindrical, rarely longer than the thorax with a distinct moderately thick petiole. The antennae are long, filiform, usually slender, the flagellar joints elongate and fusiform, rarely more or less distinctly excised at apex, and always with long hairs which are sometimes arranged in whorls.

---

[2] Proc. Ent. Soc. Wash., vol. 24, 1922, p. 55.

HARMOLITA LOLII, new species.

Female.—Length 3.5 mm. Head with rugulose sculpture; viewed from in front broader than high, subtriangular in outline, subtruncate at the mouth, the cheeks nearly straight, and about as long as the height of eyes, vertex nearly straight; antennae inserted at the middle, face very broad with a tuberculiform swelling on the median line just below the antennae; antenna nearly twice as long as the height of head, the flagellum moniliform, not at all clavate; scape slightly compressed; pedicel only a little longer than broad; ring joints small; funicle apparently six-jointed, the first joint together with the ring-joints about one and one-half times as long as pedicel, second and third joints subequal, each slightly longer than broad and distinctly shorter than the first joint; fourth, fifth, and sixth joints subequal and subquadrate; club 2-jointed, the joints subequal in length and each barely longer than broad. Pronotum rugulose with a few obscure umbilicate punctures; mesoscutum and scutellum similarly sculptured but with the umbilicate punctures more numerous and more distinct although very shallow and irregular, subopaque; parapsidal grooves deep and foveolate; propodeum rugose, with a shallow depression medially which is sculptured within like the rest of propodeum and is without carinate margins; marginal vein about twice as long as postmarginal, the stigmal and postmarginal subequal; abdomen as long as the thorax, broadly fusiform in outline, not conically pointed at apex and not compressed from the sides, the dorsum more or less flattened; first tergite comprising approximately one-third the length of abdomen, following tergites subequal, the fourth and fifth slightly longer than the second and third. Black, lateral anterior angles of the pronotum with a pale yellow or whitish spot which is scarcely visible from above; all knees and all tarsi more or less brownish or piceous; wings hyaline, the submarginal vein dark brown, rest of venation yellowish; exposed tip of ovipositor sheaths yellowish.

Male.—Length 3 mm. Similar to the female except as follows: Antennal scape distinctly swollen beneath between middle and apex; pedicel subspherical; ring joints minute; flagellum beyond the ring joints composed of seven joints which are not at all differentiated into funicle and club, the joints incised at apex, the first fully three times as long as thick with several whorls of long blackish hairs; second joint shorter, slightly more than twice as long as thick; following joints subequal, each a little shorter than the second and like the second each with a basal and a subapical whorl of long hairs; median depression on the propodeum obsolete or very inconspicuous; abdominal petiole moderately thick, not quite twice as long as broad and not reaching to the apices of hind coxae, longitudinally tricarinate above and weakly rugulose between the carinae, abdomen beyond the petiole subcylindrical and polished; whole abdomen equal to approximately two-thirds the length of thorax and much narrower than the thorax. Color as in the female except that the legs are entirely black, the pronotal pale spots are not so conspicuous though present, and the marginal and stigmal veins are fuscous.

Type locality.—Elk Grove, California.

Type.—Cat. No. 24986, U.S.N.M.

Type female and ten female paratypes from the type locality, reared April 22, 1921, by B. G. Thompson from stems of *Lolium temulentum* Linnaeus, and recorded under Sacramento No. 20248. Allotype male, a male paratype and thirteen female paratypes from Bird's Landing, California, reared April 20, 1921, by the same collector from the same host plant, and recorded under Sacramento No. 20292. Also six female paratypes reared by the same collector April 21, 1921, from *Lolium multiflorum* Lamarck, collected at the last named locality, and recorded under Sacramento No. 20294.

Mr. C. M. Packard, in charge of the Bureau of Entomology Laboratory at Sacramento, California, has furnished an interesting summary of notes on the species made by himself and Mr. Thompson. According to this summary the species is certainly phytophagous. Green and succulent stems of *Lolium temulentum* collected May 22, 1918, were heavily infested. Almost every stem contained one or two of the larvae which hollow out elongate oval cells in the center of the stem. Messrs. Packard and Thompson are not yet sure of the life cycle but state that such scattered observations as they have been able to make indicate that the species has but one generation a year, the adults emerging from the previous year's growth early in spring, ovipositing in the young grass of the current season, the larvae maturing in early summer and remaining quiet in the stems either as larvae or pupae until the following spring.

Family PTEROMALIDAE.

Genus POLYSCELIS (Ashmead) Dalla Torre.

As represented by *P. websteri* Ashmead and the new species here described, this genus very closely resembles *Eupteromalus* Kurdjumoff, but may be distinguished by the immargined occiput, the more distinctly hairy dorsal surface of the hind coxae, and the more or less compressed and expanded apical half of the middle tibiae of the male.

The two American species may be separated as follows:

1. Females ---------- 2.
   Males ---------- 3.

2. All coxae metallic; forewing with a fuscous cloud on disk; antennal flagellum blackish or very dark brown____________________**modestus**, new species.
   All coxae for the most part testaceous, the posterior pair more or less tinged with metallic outwardly; forewing without a fuscous cloud; flagellum dark reddish testaceous________________**websteri** Ashmead.
3. Funicle joints subequal and all distinctly longer than broad; flagellum uniformly fuscous; middle tibiae only slightly clavate, and weakly compressed at apex________________________________**modestus**, new species.
   Third and fifth funicle joints subquadrate, narrower and much shorter than the other funicle joints; the funicle joints alternating white and dark brown; middle tibiae strongly compressed and expanded between middle and apex______________________________________**websteri** Ashmead.

POLYSCELIS MODESTUS, new species.

Female.—Length, 2.2 mm. Head and thorax closely and strongly punctate; abdomen polished. Head transverse, a little more than three times as broad as thick antero-posteriorly; viewed from in front, slightly broader than long, not or but slightly narrowed below, clypeal area with converging striae; malar space equal to about half the eye-height; eyes ovate, without pubescence; ocellocular and postocellar lines approximately equal; occiput concave, transversely reticulate, without any indication of a marginal carina; antennae rather slender, subclavate, with two ring joints, a six-jointed funicle, and a three-jointed club; first funicle joint and ring joints combined distinctly longer than the pedicel; all funicle joints a little longer than broad, the last nearly quadrate; club slightly longer than the two preceding funicle joints combined; pronotum sculptured like the occiput, but with the narrow posterior margin of the strongly transverse dorsal portion smooth; mesoscutum with the parapsidal grooves deeply impressed anteriorly, but fading out entirely posteriorly; sculpture of scutellum and axillae similar to that of mesoscutum, but more dense, the punctures somewhat smaller; propodeum with a large subglobose neck, which is set off from the rest of the propodeum by a rather deep transverse groove or constriction; lateral folds of propodeum strongly developed, median longitudinal carina weak, the area between the folds and including the neck coarsely punctate, laterad of the folds weakly sculptured and densely hairy; anterior wings reaching beyond the apex of abdomen; postmarginal vein distinctly longer than the stigma and subequal to or very slightly shorter than the marginal; hind coxae conspicuously covered with hairs dorsally; abdomen pointed ovate, about as long as thorax, weakly convex dorsally, the first and second tergites combined constituting about half its length, the first tergite equal to about twice the second. Head and throax brassy-green, the clypeal region, under side of throax, and the propodeum more or less tinged with bluish; antennal pedicel and flagellum blackish; scape reddish testaceous, with the apex fuscous; all coxae metallic like the thorax; remainder of legs reddish testaceous, the apical tarsal joint dark brown; abdomen black; wings hyaline, the fore wing with a large subcircular, not very distinct fuscous cloud in the middle.

Male.—Length, 1.7 mm. Flagellum cylindrical, the club not or scarcely thickened, funicle joints each approximately one and one-half times as long as broad and subequal; ocellocular line a little shorter than the postocellar; transverse constriction at base of propodeal neck not as deep as in the female; abdomen shorter than the thorax, ovate, not pointed at apex; median tibiae weakly clavate and slightly compressed toward apex. Head and thorax highly metallic blue-green; scape pale, flagellum dark brown or fuscous; legs, including all coxae, pale testaceous, the middle tibiae except narrow base black; apical tarsal joint blackish; wings hyaline, without a fuscous spot. Otherwise like the female.

Type locality.—Hanover, Pennsylvania.

Type.—Cat. No. 22834, U.S.N.M.

Host.—*Mayetiola destructor* Say.

The type material consists of five females and thirty-five males, all either reared or bred from Hessian fly puparia, by Messrs. W. R. McConnell and P. R. Myers. The type and allotype were reared from puparia collected at Hanover, Pennsylvania. Seven of the male paratypes are progeny of the type female and bear Cage No. 972. Female paratype A, also from Hanover, is the parent of fourteen male paratypes bearing Cage No. 987, and one bearing Cage No. 992. Paratype females B, C, and D, from Carlisle, Pennsylvania, are the parents of twelve males bearing Cage No. 998.

Family EUPELMIDAE.

ANASTATUS MICROCENTRI, new species.

This species is characterized by a complete narrow transverse hyaline band on the forewing, a flattened vertex, and by its unusually uniform dark color.

Female.—Length 4.5 mm. Head rugosely and nearly uniformly sculptured, transverse, a little more than twice as broad as thick antero-posteriorly; vertex flattened and sloping gradually from the posterior ocelli; lateral ocelli about their own diameter from the eye margin; head viewed from in front distinctly broader than long; cheeks evenly rounded; malar space rather long; malar groove distinct; antennae rather long, inserted a little above the lower extremities of eyes; scape extending far above the vertex; first funicle joint and the ring joint combined fully twice as long as the pedicel, following funicle joints gradually decreasing in length; fifth subquadrate, sixth and seventh very slightly broader than long; club about equal in length to the three preceding funicle joints, three-jointed, the sutures between joints not very distinct; pronotum viewed from above triangular, slightly broader than long and faintly lineolated; lateral lobes and anterior portion of median lobe of mesoscutum weakly sculptured and shining, median lobe posteriorly with sculpture similar to that of scutellum but not so strong; scutellum and axillae opaque above, the perpendicular margins polished; propodeum mostly polished; wings rather slender and extending barely beyond the apex of abdomen; hind femora above between middle and base distinctly swollen; abdomen about equal in length to the thorax exclusive of pronotum, broadly rounded at apex, smooth at extreme base, reticulately rugulose beyond, the apical tergites opaque; fourth tergite broadly emarginate at apex; ovipositor barely exposed at tip. Head dark greenish-bronze in color; thorax black with a metallic or aeneous tinge on mesoscutum and pleura, the sutures and pleura more or less tinged with brownish; antennal scape rufous, darker at apex; pedicel and flagellum bronzy-black; legs all dark brown; forewing fuscous with the base hyaline to the apex of submarginal vein and a complete narrow transverse curved hyaline band near the middle; posterior wing entirely hyaline; abdomen black with irregular broad whitish band at apex of first segment; tip of ovipositor pale.

Male.—Length 2.3 mm. Head, viewed from above, appearing three times as broad as thick antero-posteriorly; eyes hairy, lateral ocelli very slightly less than the diameter of an ocellus from the eye margin; vertex slightly convex, not flattened; viewed from in front the head is slightly broader than high, the cheeks rounded; antennae inserted very slightly above the lower extremities of the eyes, well separated at base; scrobes triangular and well defined, not deep; scape short and moderately thick, not extending above the vertex; pedicel small and subspherical; flagellum long and thick, fully twice as long as the height of head, nearly uniform in thickness throughout, the base and apex slightly tapering; first funicle joint distinctly more than twice as long as thick; second and third joints subequal and about twice as long as thick; fourth joint hardly one and one-half times as long as thick; fifth, sixth, and seventh, successively decreasing in length, the seventh quadrate; club apparently solid, not thicker than the funicle, bluntly pointed at apex, and equal in length to the three funicle joints preceding it. Pronotum, mesoscutum, axillae, and scutellum with nearly uniform shallow reticulate-punctate sculpture, subopaque; propodeum shining, very faintly reticulate with a weak carina at the middle; middle tibial spur subequal in length to the first tarsal joint, slender; abdomen much narrower and shorter than the thorax, smooth at base above, more or less faintly reticulate elsewhere. Dull aeneous black with the head anteriorly and the cheeks more strongly metallic, appearing blue-green or brassy in some lights; antennae dull black with the scape slightly aeneous; legs black, extreme apex of middle and front femora, base of all tibiae (broadest on the median pair), extreme apex of middle and front tibiae, and all tarsi except the apical joint pale; wings hyaline.

Type locality.—Carlisle, Pennsylvania.

Type.—Cat. No. 24987, U.S.N.M.

Type, allotype, and two paratypes reared by P. R. Myers, August 18–21, 1917, from eggs of a katydid, *Microcentrum*, species, under Cage No. 1056. Also four paratypes reared at Washington, District of Columbia, April 20, 1891, from the eggs of a *Microcentrum* which may or may not have been the same species.

EUPELMUS POPA Girault.

Eupelmus popa GIRAULT, Descriptiones Hymenopterorum Chalcidoidicarum Variorum cum Observationibus, pt. 5, 1917, p. 4. (Private publication.)

This species was described by Girault from five female specimens which are in the United States National Museum under Type Catalogue No. 21422. These specimens were received from P. J. Van Breemen, by whom they were reared at Curacao, Dutch Antilles, in connection with *Contarinia sorghicola* Coquillet.

In addition to the type material the National Collection contains the following material determined by the writer as this species: Fourteen specimens from San Antonio, Texas, reared by C. H. Gable, July 15, 1920, from *Contarinia sorghicola* under his T. No. 76; eight specimens from the same place and the same host, reared by Gable August 18, 1920, and recorded in the Bureau of Entomology, U. S. Department of Agriculture under Webster No. 5357, T. No. 104; one female taken at Limones, Cuba, by W. M. Mann on sacks of grain; eleven specimens bearing lot No. 15, reared by K. K. Kannan at Chumurajhagar, India, July 27, 1915, from a Cecidomyid infesting sorghum; and six specimens under lot No. 19, from Nanjangua, India, also reared by Kannan from the same Cecidomyid host.

The material from India was transmitted to the writer through the Bureau of Entomology by Mr. C. H. Gable, who stated that the Cecidomyid host from which the parasites were reared had been determined by Dr. E. P. Felt as *Contarinia caudata* Felt, which species, according to Mr. Gable, "seems to be very close to our *Contarinia sorghicola*, if not identical."

The specimens of this parasite from India and those from the United States and the West Indies seem to be identical in every respect. Its occurrence in two such widely separated parts of the globe is difficult to explain except upon the supposition that its host has been transported from one country to the other. While not conclusive evidence, the parasite record tends to confirm the suspicion that *Contarinia sorghicola* and *C. caudata* are the same species.

The original description of *Eupelmus popa* is short and based upon the female sex only. Following is a more detailed description of both sexes:

The species is not a wholly typical *Eupelmus*. The middle tarsi are swollen but the spines beneath are pale and inconspicuous; the axillae are not broadly separated at base and the postmarginal vein is only slightly longer than the stigmal. The abdomen is collapsed and shrivelled so that one can not determine whether or not the dorsal segments are emarginate.

Female.—Length, 2 mm. Slender; head and thorax rather weakly reticulately sculptured, the malar space a little more strongly so than the rest of head; head transverse, not broader than the thorax; scrobes triangular, deep; eyes bare, not large; lateral ocelli about the diameter of an ocellus from the eye margin; antennae inserted slightly below the eyes, 13-jointed, clavate; scape rather short, slightly compressed; pedicel rather slender, more than twice as long as broad; ring-joint about half as long as broad; funicle 7-jointed, not counting the ring-joint; the first subquadrate; second distinctly longer than broad; third the longest and fully one and one-half times as long as broad; fourth nearly as long as the third but broader; fifth and sixth subquadrate; seventh somewhat broader than long; club 3-jointed, ovate, about equal in length to the three preceding funicle joints; mesoscutum deeply impressed behind, parapsidal grooves deeply impressed anteriorly, the triangular median lobe short and convex; legs moderately long, middle tarsi rather short; submarginal vein equal to the marginal and postmarginal combined; stigmal a little shorter than the postmarginal; abdomen a little longer than the head and thorax, somewhat compressed, conically pointed at apex, weakly sculptured; ovipositor sheaths about four-fifths as long as the abdomen.

Head, thorax, coxae, and abdomen dorsally except at apex, metallic green; apex of pedicel, ring-joint, tegulae, triangular pleural plate in front of the tegulae, legs except coxae, and abdomen beneath pale yellowish; antennae except as noted black, the scape more or less metallic; middle femora near apex usually with a small brownish spot in front, their tibiae with a narrow dark brown band near base; abdomen apically above and at sides more or less brownish; wing hyaline.

Male.—Length, 1–2 mm. Sculptured like the female. Parapsidal grooves distinct, narrow, not deeply impressed; abdomen shorter and narrower than the thorax. Head, thorax, and abdomen entirely metallic green; base and ventral margin of scape to near apex, apex of pedicel, ring-joint, palpi, tegulae, and legs except coxae pale yellowish; middle femora and tibiae without brownish spots or bands and the prepectus concolorous with the rest of thorax.

Redescribed from the above mentioned material in the United States National Museum.

CALOSOTER METALLICUS, new species.

Plate 1, figs. 1, 2, and 3.

In Ashmead's generic key to Eupelminae this species runs first to *Charitopus* but does not agree since the mesonotum is somewhat impressed and the axillae broadly separated at base of scutellum. If category 7 in the key is ignored it runs satisfactorily to *Calosoter* except that the eyes are not entirely bare but sparsely set with very short inconspicuous hairs. In Schmiedeknecht's key[3] it runs more readily to *Calosoter* and agrees very well with the generic description.

Female.—Length 2.4 mm. Head with rather weak reticulate-punctate sculpture, strongest on the vertex; antennae (pl. 1, fig. 2) rather short, scape not reaching to front ocellus, pedicel a little longer than the combined ring-joint and first joint of funicle; ring-joint about as long as broad; first funicle joint not over one and one-half times the length of ring-joint; second about twice as long as broad, and about equal to the combined first funicle and ring-joint; third and fourth subequal and slightly shorter than the third; fifth subequal in length to the first but broader; sixth subquadrate and the seventh slightly transverse; club short, ovate, about equal in length to the three preceding funicle joints; mesoscutum and scutellum strongly sculptured, the former only slightly depressed on the disc, its sculpture consisting of shallow more or less irregularly shaped punctures or areas set off by raised lines, the scutellum with similar sculpture but the areas more minute and elongate giving a more or less longitudinally lineolate appearance; axillae very small and widely separated; propodeum nearly smooth dorsally, its lateral aspect faintly sculptured and hairy; mesopleura weakly reticulate; basal joint of median tarsi somewhat swollen, without the usual stout spines beneath or if present they are colorless and very weak; abdomen about equal to the head and thorax in length, with distinct fine sculpture all over, the first to fourth tergites emarginate medially, the fifth broadly concave at apex; ovipositor sheaths extending very slightly beyond the apex of abdomen; wings with the costal cell and basal area, except at the posterior margin of the wing, as well as the discal portion of the wing closely set with fine, short cilia; stigmal vein slightly shorter than the postmarginal, the marginal about four times as long as the postmarginal. Antennae shining black, the scape more or less metallic blue; head deep steel blue, with the vertex faintly brassy; thorax and abdomen above metallic green, the abdomen with coppery reflections; under side of the thorax and all legs blue-green, the knees, apices of all tibiae and all of the tarsi except the apical joint pale; wings hyaline, ovipositor sheaths black.

---

[3] Wytsman's Genera Insectorum, Chalcididae, p. 170.

Male.—Antennal pedicel not quite as long as the combined ring-joint and first funicle joint; sixth and seventh funicle joints subquadrate or very slightly longer than broad; club a little shorter than the three preceding funicle joints combined (pl. 1, fig. 3); abdomen a little shorter than head and thorax together; posterior margins of none of the tergites emarginate. Otherwise the male is like the female except that the general color is a little more highly metallic.

Type locality.—San Miguel, California.

Type.—Cat. No. 24988, U.S.N.M.

Type and six female paratypes from the type locality reared by C. M. Packard in July and August, 1916, from wheat steams containing *Harmolita*, species, and recorded in the Bureau of Entomology under Webster No. 13368. Allotype male from Estrella, California, reared by Mr. Packard from similar material and recorded under the same Webster number. Also one female from Concord, California, reared, according to the labelling, from *Phytophaga destructor* (Say) by M. C. Lane.

Family EULOPHIDAE.

Subfamily APHELININAE.

COCCOPHAGUS SAISSETIAE, new species.

This species is apparently distinct from any described species in the color of the legs which, in the female, are entirely yellowish-white with the exception of the hind tibiae which are mostly black.

Female.—Length 1.2 mm. Eyes hairy; entire front of head with the exception of antennal grooves granularly opaque; antennal scape rather short, pedicel only slightly longer than broad; first funicle joint the longest, about one and two-third times the pedicel; second funicle joint a little shorter than the first; third not quite as long as the second; club 3-jointed not much thicker than funicle, conic-ovate, and about as long as pedicel and first funicle joint combined; mesoscutum and scutellum finely shagreened, more or less shining and rather thickly set with greyish hairs; mesopleura smooth; marginal vein of forewing longer than submarginal, marginal cilia short. General color black; head, except occiput above, lemon yellow; scutellum apically bordered with yellow, this border comprising approximately one-fourth the length of scutellum; scape, all coxae and femora, fore and median tibiae, and all tarsi yellowish-white; hind tibiae black with the apex pale; tarsal claws black; tegulae and narrow margin of mesoscutum before tegulae pale; wings hyaline, venation dark brown.

Male.—Length 0.75 mm. Antennal club as long as pedicel and first two joints of funicle combined; pedicel not longer than broad. Head, thorax, and abdomen black; antennal flagellum dark brown: scape, and apex of postscutellum whitish; all coxae, basal half of middle femora, basal two-thirds of hind femora, hind tibiae except at apex and apical joint of all tarsi black or blackish; rest of legs white; otherwise like the female.

One male paratype has the front femora blackish at base and the hind femora and tibiae entirely black.

Type locality.—Ancon, Canal Zone, Panama.

Type.—Cat. No. 24989, U.S.N.M.

Host.—*Saissetia nigra* Nietner.

Three females and three males reared from the above named scale insect by J. Zetek.

It is possible that the above described males may be wrongly associated with the females. Except in color they appear to agree nicely, however, and since considerable antigeny in color characters is known to exist in other species of this genus, they are believed to be the same species.

Subfamily TETRASTICHINAE.

TETRASTICHUS FASCIATUS Ashmead.

This species, of which the United States National Museum Collection contains seven specimens from the type series, was originally described from collected specimens taken on the island of St. Vincent, West Indies. In the same collection is a single specimen, determined by Mr. A. A. Girault as a variety of *fasciatus*, which was reared from *Contarinia sorghicola* by P. J. Van Breemen at Curacao, Dutch Antilles.

A series of twenty-four specimens of a *Tetrastichus* reared by K. K. Kannan from *Contarinia caudata* Felt infesting sorghum at Chumurajhagar, India, and sent under his lot No. 15, as well as a smaller series consisting of eleven specimens reared by the same collector from the same host at Chintaman, India, sent under his lot No. 17 have been compared with the types and are believed to be the same species. Structurally the Indian specimens apparently agree in every detail with those from the West Indies. The color is also the same, except that in the Indian specimens the head and thorax are of a duller yellowish than in the types, appearing more or less infuscated. This fuscous tinge is believed to be discoloration, due to action of the preserving fluid in which they were sent. The following description of the two sexes is drawn up from the above-mentioned specimens from India.

Female.—Pale yellowish, more or less tinged with fuscous, the second to sixth dorsal abdominal segments bordered at apex with brownish; antennal flagellum brownish. Head and thorax almost sculptureless, the dorsum of latter very faintly lineolated; mesoscutum with a delicate median groove; propodeum short with a delicate median carina; abdomen ovate, a little longer than the head and thorax; ovipositor slightly exserted. Antennae apparently with four ring-joints; first funicle joint subequal in length to the pedicel; about two and one-half times as long as broad; second funicle joint subequal to the first; third slightly shorter; club about as long as two preceding funicle joints, 3-jointed, the apical joint small, indistinctly separated from the preceding and terminating in a short spur. Wings hyaline, the marginal vein distinctly longer than the submarginal; postmarginal subobsolete; stigmal approximately one-third as long as the marginal.

Male.—Length 1.3 mm. Color and sculpture like that of female, except that the apical half of abdomen is blackish. Abdomen small, narrower and shorter than the thorax; antennae elongate slender; scape on ventral margin near apex with a distinct ovate spot, probably a sensory gland, which is dark brown in color; pedicel obconical, not twice as long as thick; three very minute ring-joints; funicle joints four in number, each with a half whorl of very long hairs near the base; first joint slightly longer than broad and slightly thicker than the pedicel; second and third joints subequal, thickest at base, each approximately two and one-half times as long as the thickest portion is broad; fourth joint similar to the two preceding, but very slightly shorter; club elongate, slender, a little longer than the two preceding funicle joints combined, distinctly 3-jointed, the basal joint with a whorl of hairs similar to that of the funicle joints; joints two and three more or less hairy, but the hairs shorter and not arranged in a distinct whorl; joints one and two subequal in length; apical joint slightly shorter, conical and terminating in a short spine.

Subfamily ELACHERTINAE.

ARDALUS INSUETUS Gahan.

Euplectrus insuetus GAHAN, Proc. U. S. Nat. Mus., vol. 48, 1914, p. 164.

Mr. A. A. Girault[4] has correctly pointed out that this species does not belong in *Euplectrus* where it was originally placed by the writer. Girault, however, does not indicate where it should be placed.

---

[4] Can. Ent., vol. 48, 1916, p. 265.

In connection with the study of the new species described below the writer has arrived at the conclusion that the correct position for *insuetus* is in the genus *Ardalus* where it is very closely related to the genotype species, *A. aciculatus* Howard. In fact, its resemblance to *aciculatus* is such that it is not an easy matter to separate them. *A. aciculatus* is represented in the National Collection by a single cotype female the head of which has been removed by Girault and mounted in balsam upon a slide where it has been ground to bits beneath the cover-glass in an attempt to get at the mandibles. The head from the type of *insuetus* has suffered a similar fate. From what is left of the types it is possible to point out the following differences.

Dorsum of scutellum between the two parallel grooves nearly twice as long as broad; parapsidal grooves very indistinct posteriorly; abdomen at base above reddish yellow but with the margins darker, the yellowish area rounded and not sharply defined; hind coxae inwardly rufous, outwardly black; thorax and abdomen not broad ---------- **aciculatus** Howard.

Scutellum between the grooves nearly as broad as long; parapsidal grooves distinct but delicate posteriorly; abdomen at base pale yellowish, nearly white, the pale area extending to the margins and terminating posteriorly in a nearly straight line at about one-third the abdominal length; hind coxae inwardly as well as outwardly black or piceous; thorax and abdomen rather broad ---------- **insuetus** Gahan.

ARDALUS ANTILLARUM, new species.

Female.—Length 2 mm. Very similar to *insuetus* Gahan but more slender in form, with the dorsum of the scutellum between the parallel grooves distinctly longer than broad, the mesoscutum more deeply sculptured and less shining; the hind coxae pale rufous on the inner side and the hind tibiae brownish at apex. Differs from *aciculatus* Howard by having the mesoscutum more strongly sculptured, and the base of abdomen entirely pale yellow. Distinguished from *politus* Howard by the aciculate-striate scutellum, and from *levigatus* Howard by the sculptured frons and the absence of a dark patch on the forewing.

Frons and vertex faintly shagreened, the latter with a few moderately large round punctures, lower part of frons and the face and cheeks nearly smooth; antennal scape slender with five erect and nearly equally spaced spines on the ventral margin, the one nearest apex of scape longest and about its own length from apex; pedicel a little longer than broad and narrower than the funicle; ring-joint small; first funicle joint the longest and nearly twice as long as the pedicel; following joints subequal in length, increasing slightly in breadth, the fourth joint subquadrate; club ovate, not as long as the two preceding joints combined, with two distinct joints and a very small and indistinct terminal one; pronotum and mesoscutum finely rugulose, subopaque, the parapsidal grooves posteriorly delicate but distinct; scutellum longitudinally aciculate-striate, somewhat shining; axillae similarly sculptured but the lines are not longitudinal; propodeum mostly smooth, but with the spiracular grooves more or less distinctly foveolate and a weak groove on each side of the median carina and contiguous to it faintly sculptured; postmarginal vein of forewing very nearly twice as long as the stigmal; marginal nearly twice as long as postmarginal; second joint of hind tarsi longer than the metatarsus; inner spur of hind tibia twice as long as the outer spur and subequal in length to the metatarsus; hind coxae reticulate; abdomen approximately twice as long as broad, about equal in length and breadth to the thorax, subovate in outline and perfectly smooth; ovipositor not exserted. Black with the frons and face slightly metallic green; antennal flagellum dark brown; scape, legs and a little more than the basal one-third of abdomen pale yellowish; hind coxae on the outer face piceous black, hind tibiae at apex brownish; wings hyaline.

Male.—Length 1.6 mm. Agrees in every way with the description of the female.

Type locality.—Caguas, Porto Rico.

Type.—Cat. No. 25063, U.S.N.M.

Type female, five paratype females and the allotype male received from G. N. Wolcott with the statement that they were bred from larvae of *Prenes nero* Fabricius, May 10, 1921.

Family TRICHOGRAMMIDAE.

PSEUDOBRACHYSTICHA SEMIAUREA Girault.

Plate 1, fig. 6.

This species apparently differs from the description of the genus *Paruscanoidea* in that the hind wings are rounded at apex, the ovipositor is not at all extruded beyond the apex of abdomen, and the antenna is apparently 5-jointed, consisting of scape, pedicel, an obscure ring-joint, and a two-jointed club. In other characters and especially in the absence of discal cilia and the long marginal vein of the forewing (pl. 1, fig. 6), which are the most striking features of the genus, it seems to agree exactly with Girault's description of *Paruscanoidea* and the characters in which it disagrees are so slight, the presence or absence of an antennal ring-joint being especially difficult to make sure of, that I am inclined to believe it belongs to this genus. The color pattern of the body and wings agrees closely with *P. dickensi* Girault and there seems to be no room for doubt that the two species are related. If this conjecture is correct. then *Pseudobrachysticha* is a synonym of *Paruscanoidea.* The matter can only be settled by a study of the types of *P. dickensi* which are in Australia. Until this is done the present name is best retained.

Female.—Length 0.6 mm. Head and thorax under high magnification apparently granularly sculptured, the head more distinctly so; ocelli in a low triangle, the lateral ocelli distant from the eye margin by approximately the diameter of an ocellus; antennae short, the scape subcylindrical and apparently a little shorter than the club; pedicel rather thick and very slightly longer than broad; ring joint, if one is present, exceedingly minute and more or less invaginated; fourth joint of antenna as thick as the pedicel, strongly transversely wedge-shaped, the dorsal margin longer than the ventral margin; fifth joint as long as the scape or nearly, acuminate at apex, with an obsolescent suture indicated slightly beyond the middle; parapsidal grooves deep and distinct; praescutum large, about as broad as long; parapsides small; scutellum transverse, fully twice as broad as long, the apex rounded; axillae lying almost wholly in front of the groove separating praescutum and scutellum; forewing rather short and broad, and almost squarely truncate at apex, rounded only at the posterior apical angle; marginal vein as long as the submarginal; stigmal vein thickened and consisting of a shortly petiolated knob with a distinct thumb-like uncus on its anterior margin; postmarginal obsolete but the anterior margin of the wing beyond the stigmal vein and extending to the wing apex thickened and covered with cilia similar to those on the marginal vein; disk of wing mostly bare of cilia except for a row of from two to four hairs running from the apex of stigmal vein to the apical margin of the wing and another short row of from two to four rather conspicuous pores close to the posterior margin at the posterior apical angle of the wing; marginal cilia beginning at the anterior apical angle and extending around to the posterior angle, these hairs a little more than one-third as long as the greatest wing breadth and nearly uniform in length; posterior margin of wing without cilia; posterior wing rather sharply rounded at apex and bare of discal cilia except for three or four hairs on the apical middle, its marginal cilia approximately twice as long as the wing breadth, starting at a point on the anterior margin about midway between the apex of the venation and the wing apex and extending around the apex and on the posterior margin nearly to the base of wing; legs moderately stout, the femora slightly swollen, the apical tarsal joint a little the longest of the tarsal joints; tibial spurs distinct; abdomen about as long as the head and thorax, broadly sessile, narrowing gradually toward the rounded apex, the ovipositor wholly concealed from above and about equal to half the length of abdomen. Head, thorax, and appendages pale yellow, the abdomen black; wings distinctly infuscated from the base to a little beyond the apex of stigmal vein, darkest behind the base of marginal vein and behind the stigmal vein; a broad apical band hyaline.

Male.—Length 4.75 mm. Similar in every respect to the female except that the scape is slightly more thickened, the general color is somewhat darker, and the femora and tibiae are more or less distinctly infuscated.

Redescribed from a large series of specimens received through the Bureau of Entomology from T. Bainbridge Fletcher of the Imperial Department of Agriculture of India, who stated that they were reared from eggs of *Hilda bengalensis* Distant at Pusa, Bihar, India. These specimens have been compared with the type of the species and agree in every way.

Superfamily SERPHOIDEA.

Family SCELIONIDAE.

TELENOMUS (PROPHANURUS) BUSSEOLAE, new species.

Characterized by its small size, generally polished appearance, weakly sculptured mesoscutum and by having the thorax strongly compressed dorso-ventrally.

Female.—Length 0.66 mm. Head strongly transverse, fully four times as broad as thick antero-posteriorly; occiput weakly margined above; frons polished, vertex distinctly finely punctate; antennae inserted at extreme lower margin of head, clavate, 11-jointed, the club 5-jointed; third and fourth antennal joints subequal and each about as long as broad, together subequal to the pedicel in length; fifth slightly smaller than the fourth, sixth the smallest; seventh about half as long as broad; eighth, ninth, and tenth also transverse but less strongly so than the seventh; eleventh longer than broad, conical; thorax strongly compressed dorso-ventrally; mesoscutum distinctly broader than long, rounded in front, distinctly finely punctate anteriorly and laterally, the posterior middle for about one-third the length of mesoscutum smooth and polished; scutellum, postscutellum and propodeum polished, the propodeum with two delicate narrowly separated and slightly curved carinae medially; abdomen ovate, shorter than the thorax; first tergite finely striate at base, apical two-thirds smooth; second tergite large, very finely striate at extreme base, otherwise polished; segments beyond the second very short, polished; head, thorax, and abdomen black; antennal scape and legs, except coxae, testaceous; antennal flagellum brownish; wings hyaline.

Male.—Similar in size and color to the female; antennae moniliform, 12-jointed; pedicel about as long as and a little narrower than joint three; joints three, four, and five subequal, a little longer than thick, and slightly thicker than following joints which are distinctly beadlike and scarcely longer than broad except the last which is conic-ovate.

Type locality.—Cedara, Natal, South Africa.

Type.—Cat. No. 24991, U.S.N.M.

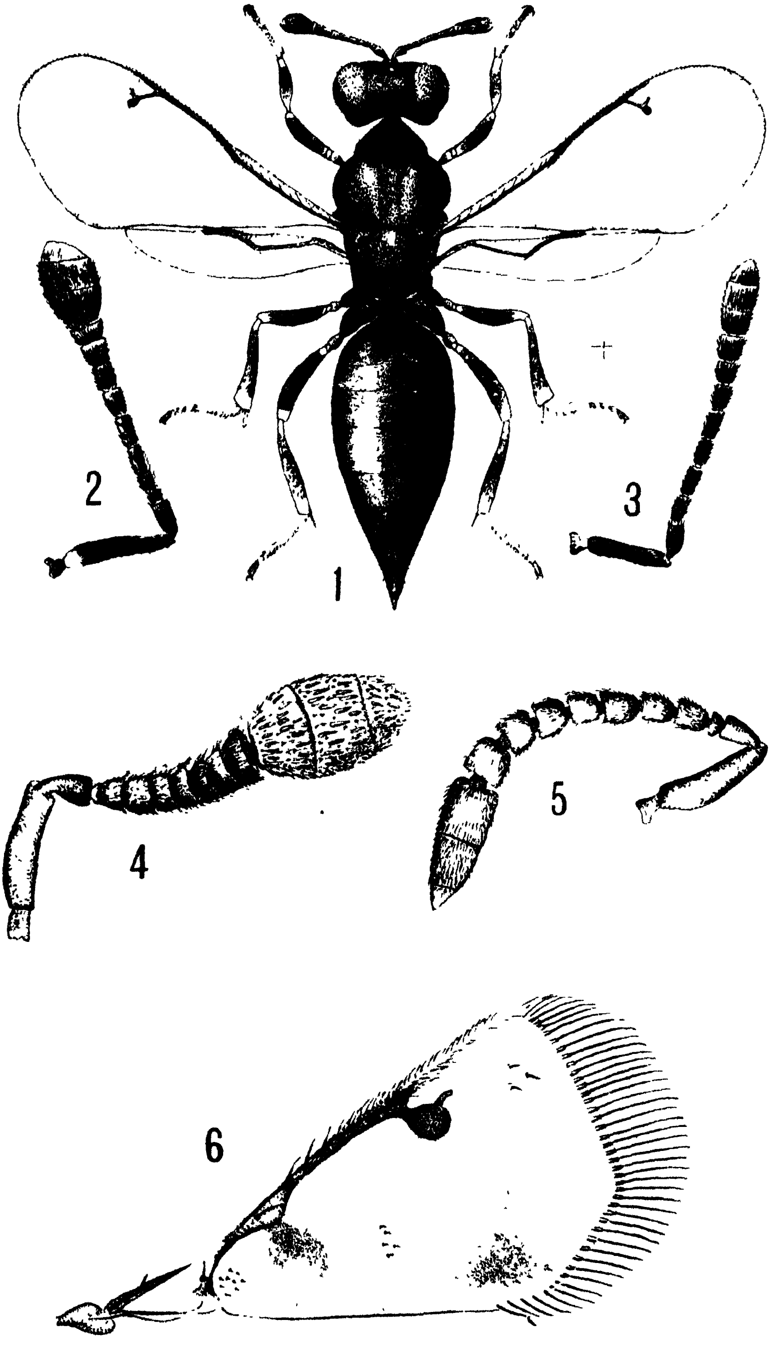
Host.—*Busseola fusca* (Hampson).

Described from twenty-one females and five males mounted on card points and three females and one male on a slide. Additional specimens in alcohol. Material received from C. W. Mally and said to have been reared from the eggs of the above-named stalk borer collected by E. S. Cogan.

EXPLANATION OF PLATE.

All of the figures on this plate were drawn under the supervision of the author by Miss E. Hart, artist of the Branch of Cereal and Forage Insects, U. S. Bureau of Entomology. (All greatly enlarged.)

FIG. 1. *Calosoter metallicus* Gahan. Adult female.
2. *Calosoter metallicus* Gahan. Antenna of female.
3. *Calosoter metallicus* Gahan. Antenna of male.
4. *Podagrion crassiclava* Gahan. Antenna of female.
5. *Podagrion crassiclava* Gahan. Antenna of male.
6. *Pseudobrachysticha semiaurea* Girault. Forewing of female.



New Reared Parasitic Hymenoptera

For explanation of plate see page 24.

TWO-WINGED FLIES OF THE GENERA DOLICHOPUS AND HYDROPHORUS COLLECTED IN ALASKA IN 1921, WITH NEW SPECIES OF DOLICHOPUS FROM NORTH AMERICA AND HAWAII.

By J. M. Aldrich,

Associate Curator, Division of Insects, United States National Museum.

The present paper is a report on the material in the genera *Dolichopus* and *Hydrophorus*, of the Dipterous family Dolichopodidae, collected by the writer in Alaska during June and July, 1921; it also contains additional new species of *Dolichopus* from Labrador, the United States, and Hawaii.

Among the localities cited are Camps 327 and 334; these are temporary names for points on the Government railroad in Alaska, the numbers indicating the miles from Seward at the south end; they are both in the south edge of the Yukon Basin, on the Nenana River, in a canyon between mountains. Healy is 358 miles from Seward.

Camp 334 has lately been given the permanent name of Carlo, and Camp 327 that of Windy, as sidings on the railroad.

Genus DOLICHOPUS Latreille.

Dolichopus Latreille, Précis des Caracteres Génériques des Insectes, Paris, 1796, p. 159.—Loew, Smiths. Misc. Colls., No. 171, pp. 18, 323, 1864.—Frey, Acta Societatis pro Fauna et Flora Fennica, vol. 40, No. 5, pp. 1–27, 1915.—Becker, Nova Acta, vol. 102, part 2, pp. 126–180, 1921.—Van Duzee, Cole, and Aldrich, Bulletin 116, U. S. Nat. Mus., 1921, 304 pp., 16 plates.

In spite of the fact that 218 species of this remarkable genus are described for North America in Bulletin 116 just cited, my work in Alaska yielded 5 new species and 2 European not previously known from North America; while 15 previously described North American species were also collected, of which 8 had never been reported from Alaska.

DOLICHOPUS MANICULA Van Duzee, Cole, and Aldrich.

Dolichopus manicula Van Duzee, Cole, and Aldrich, Bull. 116, U. S. Nat. Mus., p. 56.

Fourteen specimens, Skagway, Alaska. Originally described from high altitudes in Colorado, New Mexico, and Wyoming.

DOLICHOPUS ANNULIPES Zetterstedt.

Dolichopus annulipes ZETTERSTEDT, Insecta Lapponica, 1838, p. 710.
Dolichopus stenhammari ZETTERSTEDT, Diptera Scandinaviae, vol. 2, p. 521, 1843.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 59, 1921.

Two specimens, Healy and Nenana, Alaska. Described from Lapland and common in northern Europe; has been reported several times from Alaska and Labrador, and one specimen is known from New Hampshire (White Mountains). According to Frey, it occurs all over Finland, and is especially characteristic of Lapland. I here follow Becker's monograph in accepting *annulipes* as not preoccupied by *Porphyrops annulipes* of Meigen.

DOLICHOPUS XANTHOCNEMUS Loew.

Dolichopus xanthoenemus LOEW, Smiths. Misc. Colls., No. 171, p. 31, 1864.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 84, 1921.

Nineteen specimens, from Seward, Anchorage, Camp 327, and Fairbanks, Alaska. Originally described from Sitka, and since recorded several times from Alaska.

DOLICHOPUS GROENLANDICUS Zetterstedt.

Dolichopus groenlandicus ZETTERSTEDT, Diptera Scandinaviae, vol. 2, p. 528, 1843.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 94, 1921.

Ninety-four specimens, from Seward, Anchorage, Camps 327 and 344, Healy, and Fairbanks, Alaska, June and July. Originally described from Greenland and later reported from northern Europe. Bulletin 116 records it from Labrador and a specimen from Colorado. While that paper was in preparation I collected a series at Tennessee Pass, Colorado, altitude a little over 10,000 feet (3.05 kilometers).

DOLICHOPUS SOLIDUS Van Duzee, Cole, and Aldrich.

Dolichopus solidus VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 104, 1921.

Thirteen specimens, both sexes, Anchorage, Camp 327, and Healy, Alaska, June 15 and July 7. Described from a single male taken on the Alaska-Yukon boundary near the Arctic Ocean. The front tarsi were missing in the type. I find that they are of peculiar and distinguishing structure, being flattened horizontally (depressed). The second and third joints are very thin as viewed from above, and the fourth and fifth are widened (depressed) and fringed laterally. Second and third of equal length, together equaling the first. I obtained a male and two females of this species at Tennessee Pass, Colorado, July 9 and 10, 1919.

DOLICHOPUS RUPESTRIS Haliday.

Dolichopus rupestris HALIDAY, Entomologists' Magazine, vol. 1, 1833, p. 164.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 112, 1921.

Dolichopus festinans ZETTERSTEDT, Insecta Lapponica, 1838, p. 708.

Fourteen specimens, from Healy, and Camps 327 and 334, Alaska, June 26 to July 13. Described from Great Britain and well known from northern Europe. Frey says it is very rare in Southern Finland, but one of the commoner species of the genus in Lapland and on the Kola Peninsula.

DOLICHOPUS BREVIPENNIS Meigen.

Dolichopus brevipennis MEIGEN, Syst. Beschr., vol. 4, p. 89, 1824.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, p. 130, 1921.

Thirty specimens, from Hurricane, Camp 334, and Healy, Alaska, June 29 to July 3. Originally described from Germany; common in Denmark (Lundbeck); common throughout Finland (Frey). First reported from North America by Osten Sacken, on the identification of Loew; only a female remains of this lot in the Museum of Comparative Zoology, Cambridge, Massachusetts, and the species apparently has not been collected in North America again until now.

DOLICHOPUS RAMIFER Loew.

Dolichopus ramifer LOEW, Neue Beiträge, No. 8, p. 19, 1861; Smiths. Misc. Colls., No. 171, p. 52, 1864.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 147, 1921.

Two specimens, Fairbanks, Alaska, July 1. The species occurs as far south as Indiana and Kansas, and even Los Angeles, California.

DOLICHOPUS OBCORDATUS Aldrich.

Dolichopus obcordatus ALDRICH, Kansas Univ. Quarterly, p. 14, 1893.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 173, 1921.

Four specimens, Fairbanks and Healy, Alaska, June 26 to July 3. A common species in the western mountains of the United States, not hitherto reported farther north than Nelson, British Columbia.

DOLICHOPUS PLUMIPES Scopoli.

Musca plumipes SCOPOLI, Entomologia carniolica, 1763, p. 334.

Dolichopus plumipes VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 183, 1921.

Sixteen specimens, from Seward, Anchorage, Healy, and Fairbanks, Alaska. Described from Carniola, the species extends widely through Europe; Frey lists it as common throughout the whole of Finland. In the United States it extends as far south as South Dakota, Maine, and (in mountains) New Mexico. It has been reported from Alaska several times.

DOLICHOPUS LONGIMANUS Loew.

Dolichopus longimanus LOEW, Neue Beiträge, No. 8, p. 14, 1861; Smiths. Misc. Colls., No. 171, p. 38, 1864.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 195, 1921.

Five specimens, Anchorage and Fairbanks, Alaska, June 12 to July 2. Described from English River, Canada, and reported from Alaska by Coquillett in 1900; it occurs in the Canadian zone of Ontario and the eastern part of the United States, and even south to Virginia, but has not been reported from the western United States.

DOLICHOPUS NUDUS Loew.

Dolichopus nudus LOEW, Smiths. Misc. Colls., No. 171, p. 41, 1864.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 201, 1921.

Nineteen specimens, from Hurricane, Camp 327, and Healy, Alaska, July 7 to 13. Not definitely recognized since its description. The single type male, from "Fort Resolution, Hudson's Bay Territory," has been entirely destroyed but the wings; hence the new material is very important. Loew mentions as one character, "Hind tibiae stout but not exactly thickened, upon the first half of the hind side without hairs." This proves to be a decisive character (in the male), the bare spot being on what I would call the inner side, extending to the middle. Loew's description is ample, and the species is correctly placed in the analytical table of Bulletin 116, page 15.

DOLICHOPUS NIGRICORNIS Meigen.

Dolichopus nigricornis MEIGEN, Syst. Beschr., vol. 4, p. 82, 1824.—BECKER, Nova Acta, vol. 102, p. 148, 1920.

Dolichopus discifer STANNIUS, Isis, vol. 1, p. 57, 1831.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 202, 1921.

One male, one female, Anchorage, Alaska, June 16. Described from northern Europe; Frey reports it occurring all through Finland. Reported from Quebec and Ontario, only a few localities south of the Canadian border (Vermont, New York, Wisconsin); has been previously reported from Alaska.

DOLICHOPUS BOREUS Van Duzee, Cole, and Aldrich.

Dolichopus boreus VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 204, 1921.

?*Dolichopus discimanus* WAHLBERG, Kongl. Vet. Akad. Förhandl., vol. 8, p. 301.—ZETTERSTEDT, Dipt. Scand., vol. 12, p. 4626, 1855.

Three males, Anchorage, Alaska, June 13 and July 21. Described from Ungava Bay, Labrador. There is little doubt that *boreus* is a synonym of *discimanus* Wahlberg, but I have not seen European material, and the latter species is said to have the front coxae dark at base, which might be specific. Frey includes *discimanus* under the strictly arctic species along with *mannerheimi;* I have quoted him under that species.

DOLICHOPUS AMPHERICUS Melander and Brues.

Dolichopus amphericus MELANDER and BRUES, Biological Bulletin, vol. 1, p. 146, 1900.—VAN DUZEE, COLE, and ALDRICH, Bull. 116, U. S. Nat. Mus., p. 217, 1921.

Forty-one specimens, Fairbanks, Alaska, June 30 to July 4. The species has not been identified hitherto except in the type set of two males and three females, collected in Price County, Wisconsin, now in the American Museum of Natural History. My specimens agree with these except in having the hind tibiae somewhat infuscated on the inner side at tip, and the front coxae provided with some black hairs on the front side. I am indebted to Dr. Frank E. Lutz, curator of insects in the American Museum, for the privilege of examining these types. There is one excellent male character, present equally in the types and my specimens, which at once distinguished this species from all the nine related forms mentioned in Bulletin 116 (p. 219): On the sides of the first abdominal segment the pleural fold is rather wide open above, and in the hollow thus formed is a spot of minute grayish tomentum or erect. short fuzzy hairs, filling the hollow and extending a little dorsad of it. I have compared all the other nine species on this point.

DOLICHOPUS MANNERHEIMI Zetterstedt.

Dolichopus mannerheimi ZETTERSTEDT, Insecta Lapponica, 1838, p. 707; Diptera Scandinaviae, 1843, vol. 2, p. 500.—BECKER, Nova Acta, vol. 102, p. 163, 1920.—FREY, Acta Societatis pro Fauna et Flora Fennica, vol. 40, sep., pp. 4, 27, 1915.

Twelve specimens, both sexes, collected at Camps 327 and 334 and at Healy, Alaska, June 26 to July 13.

Not heretofore reported from North America. Originally described from Lapland. Frey includes it among a list of 20 species of Dolichopodidae of which he says (p. 4): "The oldest postglacial Dolichopodid species are those * * * which now occur only in Lapland and the Kola Peninsula, and here principally within the purely arctic field and tundra regions. The limit of forest is not decisive for them, as they may occur in the northern coniferous zone. * * * Their southern limit is approximately the Arctic Circle." (Translation.)

No European specimens have been compared, but the characters are striking, and Zetterstedt's elegant description seems unmistakable. The species is here redescribed for the benefit of American workers. In Bulletin 116 it runs to *laticornis* in Group A on page 9, from which it is separable by many characters, among them the infuscation in the wing tip.

Male.—Front green. Face pale yellow, rather narrow. Palpi black. Antennae entirely black, rather short. Orbital cilia entirely black.

Mesonotum and scutellum rather obscure green, with coppery reflections and rather distinct changeable stripes. Pleurae blackish green, but little shining. Cilia of calypters white. Halteres yellow. Abdomen rather long, dark green. Hypopygium large, the lamellae white, rather square across the apical end where they are broadly bordered with black, deeply notched and provided with the usual curved bristles; the upper border is fringed with erect hairs which become larger toward the base.

Coxae black, the front ones somewhat silvery on the anterior side, with small dark hairs. Femora black except the extreme knees; front tibiae yellow, the middle tibiae yellow but on the outer side distinctly white and without the usual small black hairs. The tip of the middle tibia distinctly infuscated, hind tibia yellow, slightly darkened at base, with the apical fifth black. Front tarsi plain, the first joint yellow except at extreme tip, the remainder black; middle tarsus with the first joint brown, its apical fourth white, on the outer side snow-white and bare, the extreme tip and all the following joints deep black; hind tarsi deep black, the first joint as long as all the following and bearing about 14 bristles in several erect rows, one of which is on the under side; the middle femora have a row of short white cilia beginning about the middle, the hind femora with a row of long white cilia from the middle.

Wings elongate, rather narrow, with a uniform gray tinge and a distinct apical dark spot, which begins at about the tip of the second vein and extends almost to the hind margin, filling out the apex except a narrow border beginning behind the tip of the fourth vein; hind cross vein bearing a slight cloud; anal angle small, costa with a distinct thickening at the end of the first vein.

Female.—Face a little wider than the male; front coxae with many more black hairs. Cilia of calypters yellow, middle tibiae not quite so wide as in the male, the middle basitarsus brown, its extreme tip black. Wing broader than in the male, the apical spot present, but less distinctly defined; hind cross vein very distinctly infuscated.

Length of male 6.2 mm.; of female 5.8 mm.

The only species known in North America which is at all similar to this one is *annulipes* Zetterstedt (*stenhammari* of authors), which also has black legs with the middle tibiae and tarsi ornamented with white. It, however, has a different color pattern and is easily separable by having black cilia on the calypters.

DOLICHOPUS LONGICORNIS Stannius.

Dolichopus longicornis STANNIUS, Isis, vol. 1, p. 53, 1831 (published 1838).—BECKER, Nova Acta, vol. 102, p. 170, 1921.

Not previously reported from North America.

Thirty-five specimens of both sexes, taken at Fairbanks, Alaska, from June 29 to July 3; compared with European specimens in my collection, determined by Doctor Kertész. Originally described from northern Europe; Frey mentions it as widespread but not abundant in Finland. Redescribed for the convenience of American students. In the analytical tables of Bulletin 116, the male runs to couplet 2 of Group F, on page 14, where it forms a third alternative "Antennae black above, yellow below including a large part of the elongate third joint."

Male.—Front green. Face shining yellow, changing to paler below. Palpi yellow. Antennae very much elongated, the first joint slender, the third very long with a slender point, the arista attached about at the middle. Antennae black, broadly yellow below including the third joint almost to its middle; the arista slightly thickened beyond the middle but slender at apex. Orbital cilia white except a few above.

Mesonotum and scutellum rather bright green. Pleurae green, overlaid with some gray dust. Calypters with white cilia. Halteres yellow. Abdomen subshining, green. Hypopygium black, green at base, the lamellae white, oval, with a sharply defined black border above, becoming wider apically, the hairs along the upper border longer and more erect than usual; the apex has the usual incisions and crooked bristles.

Front coxae yellow with pale hairs on the anterior side; middle coxae black except at tip, hind coxae yellow with a black spot on the outer side, extending down to the bristle. Femora and tibiae yellow, the hind tibiae infuscated at the tip where they are slightly swollen and have on the hind side, just before the apex, a very distinct rounded depression; the color of the front and middle tibiae is more white than usual; femora not ciliated. The middle tarsi plain, brown from the tip of the first joint; hind tarsi entirely black with only about three bristles.

Wings with a grayish tinge, rather broad, with the anal angle little developed; a very pronounced thickening of the costa at the tip of the first vein.

Female.—Face broader and grayish yellow. Antennae shorter than in the male, still noticeably elongated, with a very sharp point; the yellow color on the under side reaches almost to the tip and is very distinct on the third joint. The cilia of the calypters may be in part black. Hind tibiae scarcely at all infuscated, especially on the outer side.

Length of male 3.1 mm.; of female 3.8 mm.

DOLICHOPUS FORTIS, new species.

Male.—Front bronze green. Face brownish yellow, glistening. Palpi black. Antennae entirely black, of ordinary size. Orbital cilia entirely black.

Mesonotum and scutellum dark bronze green, a little dusted, coppery along the suture. Pleurae blackish-green, moderately dusted. Cilia of the calypters black. Halteres yellow. Abdomen rather elongated, blackish-green with bronze reflections. Hypopygium black, of moderate size, the lamellae whitish, oval, with a broad black margin apically and below, the usual incisions and crooked bristles at the apex.

Legs black, the knees very narrowly yellow; all the tarsi plain, the front ones about one-fourth longer than their tibiae; hind femora with long cilia below, most of which appear pale in favorable lights.

Wings decidedly infuscated throughout, the hind cross-vein and the curvature of the fourth vein slightly more so; costa with a short enlargement at the tip of the first vein; outline of the wing of the ordinary form.

Length 5.4 mm.

Described from one male taken by the writer at Healy, Alaska, June 23, 1921.

Type.—Male, Cat. No. 25188, U.S.N.M.

Runs to *paluster* on page 10 in the analytical table of Bulletin 116; but is a more elongated species, much less green in color, with long instead of rounded wings.

DOLICHOPUS PENSUS, new species.

Male.—Front green, not very shining. Face silvery, of moderate width and rather long. Palpi yellow. Antennae black; very much elongated, especially the third joint, which has a long slender point extending much beyond the insertion of the arista; the first joint is distinctly yellow below at the apex. Orbital cilia white except the upper ones. The head is not so wide in proportion to its height as in most species.

Mesonotum and scutellum green, not very bright. Pleurae dull green. Calypters with white cilia. Halteres yellow. Abdomen rather bright green with the usual thin pruinosity on the sides. Hypopygium rather large, the lamellae white with the usual black border and with the apex notched and bristly.

Front coxae yellow; middle and hind coxae black except tips. Front femora yellow with rather distinct but poorly defined dark shading along the middle; middle femora yellow still with faint indications of infuscation; the hind femora yellow on the basal half, gradually becoming black at the apex; the extreme tip, however, is yellow. Front and middle tibiae pale yellow; the hind tibiae black with a brown streak on the posterior except near tip; they are considerably longer than their femora and their tarsi are strikingly elongated and enlarged, and deep black in color; the second joint of the hind tarsus seems especially enlarged and noticeably flattened; the following joints of similar appearance but decreasing in size; front and middle tarsi plain, infuscated from the tip of the first joint.

Wings hyaline with a perceptible brown tinge on the anterior half except at base; costa not thickened; anal angle very much reduced.

Female.—Face a little wider than in the male, rather gray in color. Antennae longer than usual in the female, the third joint with an uncommonly sharp tip but very much shorter than in the male. Cilia of the calypters sometimes in part black. Femora colored as in the male; the hind tibiae, however, yellow except on the apical fourth; they are longer than the femora as in the male and the hind tarsi are considerably elongated and entirely black but the joints are not enlarged or flattened. The wing has a distinct brownish tinge which is not confined to the anterior half.

Length 3.1 mm.

Described from 12 males and 13 females collected at Fairbanks, Alaska, on June 30, 1921, by the writer.

Type.—Male, Cat. No. 25189, U.S.N.M.

The striking enlargement and black coloration of the hind legs suggested the name, the idea being than these characters are probably displayed while hovering in the air, the legs hanging down.

In the tables of Bulletin 116 I would put this in Group F, in spite of some infuscation of the front femora; it would then run to *acutus*, page 15, but the latter has no infuscation of any of the femora, etc.

DOLICHOPUS SIMPLICIPES, new species.

Male.—Front rather dull green. Face narrow, silvery, with a slight yellowish tinge. Palpi yellow. Antennae black, the first joint faintly yellowish below on the inner side, the third joint rather broad, but not elongated. Orbital cilia white except a few above.

Mesonotum and scutellum bronze-green, not very shining. Pleurae greenish-black, with a rather thick gray dust. Calypters with black cilia. Halteres yellow. Abdomen shining green, not very bright, a thin whitish pruinosity along the sides. Hypopygium black, of moderate size, the lamellae oval, white, with a narrow margin above and a broader one at apex, where there are the usual notches and curved bristles.

Front coxae yellow, with a small indistinct dark spot at base on the outer side; the front side with pale hairs; middle and hind coxae black except at tip. Femora yellow; the hind ones slightly infuscated at tip, not ciliated, but with unusually long black hairs on outer lower part beyond midde, with a single long preapical bristle. Front and middle tibiae yellow, the hind ones infuscated on about the apical fourth but not much enlarged; front tibia at apex below with a long slender bristle two-thirds as long as the basitarsus. All the tarsi plain, the front and middle ones infuscated from the tip of the first joint; hind ones entirely black.

Wings hyaline, rather narrow, the angle much reduced; the fourth vein with only a slight bend, ending much before the apex of the wing. Costa with a large and long thickening at the junction of the first vein.

Female.—Face considerably wider than in the male, almost white. Front coaxae with black hairs on the anterior surface. Hind femora with faint infuscation covering about the apical fourth.

Length 3.2 mm.

Described from 3 males and 2 females. All collected by the writer at Camp 327, Alaska, July 12, 1921.

Type.—Male, Cat. No. 25190, U.S.N.M.

Simplicipes runs in the tables of Bulletin 116 to couplet 10, page 17. It differs from *discolor* in having the costa thickened, and from *genualis* in not having the lamella produced in a sharp point at apex.

DOLICHOPUS CRASSICORNIS, new species.

Male.—Front bright green. Face light golden yellow, rather narrow below. Palpi yellow. Antennae wholly black, quite large, the third joint considerably elongated, about twice as long as wide; the arista inserted near the tip. Orbital cilia pale yellow except a few above.

Mesonotum bright green with a brown mark each side. Scutellum green. Pleurae green, subshining. Cilia of the calypters black. Halteres yellow. Abdomen bright green, at incisures narrowly blackish. Hypopygium black. Lamellae white, oval or somewhat rectangular, with a black border above which is wider apically, where there are the usual incisions and curved bristles.

Coxae black, the front ones slightly yellow toward the apex, especially on the front side. Femora yellow, front ones faintly tinged with brown below, the hind ones without cilia, and with a slight but distinct infuscation at the tip above. Tibiae yellow, the hind ones deep black on the apical third or more, slightly enlarged apically and bearing on the hind side just before the apex a very striking, rounded depression; the flexor side of the hind tibiae closely beset with small black suberect hairs. Hind tarsi entirely black; front and middle tarsi plain, black from tip of the first joint. The front tibia has at apex a fine curved hair-like bristle which is quite short, less than half the length of the basitarsus.

Wings hyaline, of ordinary shape; the anal angle not very prominent. The costa with a long tapering enlargement from the junction of the first vein.

Female.—Face yellow, twice as wide as the male, dull white in color. Third antennal joint of ordinary form. The front femora with quite distinct traces of brown above and below; the middle femora with faint brown tinge below; hind femora with the tip deeply infuscated. Costa not enlarged. Otherwise as in male.

Length 3 mm.

Described from 6 males and 1 female, all from Healy, Alaska, except 2 males which are from Camp 327, Alaska. Collected by the writer.

Type.—Male, Cat. No. 25191, U.S.N.M., from Healy, Alaska.

Runs to *sincerus* in the table of Bulletin 116, page 17, but has much longer antennae and a strong thickening of the costa.

DOLICHOPUS INFLATUS, new species.

Male.—Front green. Face light golden yellow. Palpi yellow. Antennae of ordinary size, the first joint wholly yellow, the others black. Orbital cilia white except a few above.

Mesonotum and scutellum bluish green, moderately bright with a coppery stripe at the suture. Pleurae green, moderately dusted with gray. Cilia of the calypters black, rather abundant. Halteres yellow. Abdomen bright green, rather coppery on the posterior part of each segment, almost wholly shining. Hypopygium rather small, black, the lamellae oval, white, with a narrow black margin, the tip incised and furnished with the usual long bristles.

Wings slightly brownish, more so toward the costa, rather narrow in shape, the hind border distinctly emarginate between the fifth and sixth vein; anal angle prominent; costa with an elongated swelling at the junction of the first vein.

Legs yellow, the middle and hind coxae black except at tip: hind femora not ciliated; all the tarsi plain, pale at base; the middle tibiae with a smooth, white inflated portion on the outer side of the apical fourth. The front coxae have rather conspicuous black hairs on the anterior side.

Length 4.8 mm.

Described from one male taken at Anchorage, Alaska, July 20, 1921, by the writer.

Type.—Male, Cat. No. 25192, U.S.N.M.

The structure of the middle tibia is about the same as in *fulvipes*, but the latter has the antennae elongated and almost entirely yellow, with several other differences. The species runs to *fulvipes* in the table in Bulletin 116, page 26.

DOLICHOPUS DELICATUS, new species.

Male.—Front bright green. Face rather wide, grayish yellow. Palpi dark yellow and quite prominent. Antennae slightly elongated, black, the first joint broadly yellow, the third sharply pointed, but not remarkably elongated. Orbital cilia yellowish white except a few above.

Mesonotum and scutellum coppery green in color. Pleurae blackish green, dusted with gray. Calypters with black cilia. Abdomen bright green with coppery reflections. Hypopygium rather small and rounded, black; the lamellae rather deep yellow, small, oval, with brownish border and at the apex some incisions and moderately long bristles.

Legs yellow, the middle and hind coxae black, the front coxae infuscated on the outer side near the base; hind femora not ciliated, hind tibiae slightly infuscated at apex and tarsi wholly black. Front tarsi with the first four joints yellow, the second, third, and fourth of almost equal length, the fifth joint black, very slightly compressed, about three-fourths as long as the fourth joint; middle tarsi infuscated from the tip of the first joint.

Wings rather brownish, of about normal shape, the costa hardly thickened at the junction of the first vein.

Female.—Front still wider than in the male, quite gray, the antennae a little shorter. The anterior tarsi are rather dark yellow to the last joint which is black but not at all compressed. The third and fourth joints are each a little shorter than the fifth.

Length 5 mm.

Described from 4 males and 3 females taken at Ungava Bay and Fort Chino, Labrador, collected by L. M. Turner.

Type.—Male, Cat. No. 25193, U.S.N.M., from Ungava Bay.

Delicatus runs to *boreus*, page 22, in the table of Bulletin 116, and greatly resembles that species; the male fore tarsi are on the same plan yet quite distinct. The fourth joint in *boreus* is very thin and elongated, and the fifth is about one-third as long but very distinctly compressed though small. In *delicatus* the fourth joint is less elongate and thin; the fifth is one-half as long, and so slightly compressed that it might almost be called plain. The lamellae in *delicatus* are smaller and more rounded than in *boreus*, and the costa is not thickened.

DOLICHOPUS ELEGANS, new species.

Male.—Front green. Face pale yellow, rather narrow below. Palpi dark brown. Antennae of the ordinary size, entirely black. Orbital cilia white except a few of the upper ones.

Mesonotum and scutellum rather shining green. Pleurae green with a little gray dust. Cilia of the calypters black. Halteres yellow. Abdomen green with bronze reflections and slight pruinosity. Hypopygium large, black, the lamellae oval, whitish, with black border which is rather wide above as well as apically, the apex has a few small incisions and longer bristles.

Legs yellow, middle and hind coxae black, front coxae blackish at base for about one-third the length and on the outer side for two-thirds; hind femora not ciliated, decidedly infuscated at tip; hind tibiae black on the apical fifth and their tarsi entirely black; front and middle tarsi infuscated from the tip of the first joint, the front ones about one-third longer than their tibiae, the last two joints distinctly flattened but without lateral fringes of any size; when viewed from above the second and third joints appear very narrow emphasizing the breadth of the last two. They are all of a gradually decreasing length.

Wings slightly infuscated or subhyaline, of ordinary shape; the costa with a rather short enlargement at the tip of the first vein.

Female.—Face dull gray, wider than in the male; front coxae almost entirely black; hind femora rather more broadly infuscated at tip. Wings distinctly wider than in the male.

Length 3.8 mm.

Described from 4 males and 1 female taken by the writer at Tennessee Pass, Colorado, altitude 10,240 feet (3.12 kilometers), July 10, 1919.

Type.—Male. Cat. No. 25194, U.S.N.M.

DOLICHOPUS LONGUS, new species.

Male.—Agrees very closely with *fortis* except in the following characters: Face dull brown instead of shining brownish-yellow; fore and middle femora with long hairs below on lower hind edge, subciliate: cilia of hind femora wholly black; hind tibiae more thickened; lamellae almost wholly blackish, only on the central and basal part a trifle lighter in color. Size and elongate form the same in both, and the elongate brownish wings are the same.

Four males, Tennessee Pass, Colorado, July 10 and 11, 1919, collected by the writer.

Type.—Male. Cat. No. 25195, U.S.N.M.

DOLICHOPUS RECTICOSTA, new species.

Male.—Front deep blue, at the sides very narrowly whitish. The face narrow, silvery white. Palpi black. Antennae short, entirely black. Orbital cilia white except a few of the upper ones.

Mesonotum deep blue with greenish reflections and in some lights a whitish pollinose triangle on each side of the suture. Scutellum deep blue. Pleurae bluish green, very thinly dusted. Cilia of the calypters black. Halteres light yellow. Abdomen greenish blue, the incisures narrowly blackish, at sides of the segments with thin silvery pruinosity. Hypopygium rather small, black; the lamellae oval, white, with a narrow dark margin apically, almost none elsewhere. At the apex there are five or six long bristles arising from prolongations of the lamellae.

Coxae and femora black, hind femora not ciliated; the knees and tibiae light yellow; hind tibiae infuscated for about one-third their length. Front and middle tarsi plain, light yellow at base.

Wings hyaline, costa not thickened; shape of the wing is very peculiar, the costal margin being much straighter than usual about to the point where the third longitudinal vein joins it. From this point it curves backward and the posterior margin has a broad uniform curve, the anal angle being very little developed. The fourth vein beyond the cross vein bends strongly forward and continues in that direction to the margin so that its tip is considerably before the apex of the wing. It is however parallel with the third vein.

Length 3.6 mm.

Described from a single male specimen from Florida, labeled "Fla."

Type.—Male, Cat. No. 25196, U.S.N.M.

Runs to couplet 30, page 14, in the table of Bulletin 116, but differs from all three species in having the costa almost straight.

DOLICHOPUS ABRUPTUS, new species.

Male.—Front steel blue; face pale golden yellow, rather narrow below; palpi yellow; antennae wholly black, of moderate length; the arista plain; orbital cilia white except on the upper third. Mesonotum and scutellum dark steel blue; pleurae green with thin gray dust; calypters with black cilia. Abdomen green; the incisures black; Hypopygium black, rather small; the lamellae ending in a very sharp point, the narrow black border entire and not very hairy. Legs yellow; the front coxae considerably infuscated on the basal third; middle and hind coxae black except tips; the hind femora and tibiae infuscated on the apical fourth. Front tarsi one and one-fourth times as long as their tibiae; the basal joint about as long as the four following, yellow; second joint about one-half as long, also yellow; the remaining joints black, the third becoming flattened toward the apex, the fourth and fifth distinctly flattened laterally but not fringed. Middle femora having a very slight tinge of brown at the apex; middle tibiae rather whitish, their tarsi infuscated from the tip of the first joint; hind tarsi entirely black; pulvilli small. Wing subhyaline, rather broad on the apical half; the anal angle however conspicuously narrowed; costa not thickened at tip of first vein.

Length 3.9 mm.

One male, Lake Tear, Essex County, New York. Collector unknown. Received from M. C. Van Duzee.

Type.—Male, Cat. No. 25410, U.S.N.M.

Runs to *virga* on page 17 of the analytical table of Bulletin 116, but differs in the male in having the front steel blue, the anal angle of the wing conspicuously reduced in size and the third and fourth joints of the front tarsi not broadly fringed so as to have the appearance of a tassel.

DOLICHOPUS TOWNSENDI, new species.

Male.—Front green, face pale yellow, quite narrow below; palpi yellow; antennae of moderate size, the first two joints entirely yellow, third entirely black, not at all elongated; orbital cilia pale, about six of the upper ones black; thorax and abdomen bronze green with a considerable whitish dust, which in certain lights partly obscures the ground color. Pleurae of the same color but a little more dusted; calypters with black cilia. Hypopygium long and stout with exceptionally large lamellae, which are widest near the apex, rather truncate, white except a narrow apical and still narrower upper border; the apical margin begins below with long processes bearing cilia, these become gradually shorter at the upper corner and bear a rather uniform row of cilia. Legs yellow; all the tarsi blackened from the tip of the first joint, the second joint, however, more or less pale at base; fore tarsi plain, not much longer than the tibiae; front coxae without dark hairs except near the tip; middle and hind coxae brown as far as the bristle; hind femora without cilia, middle and hind with only one preapical bristle, hind tibiae not at all enlarged, on the hind side free from hairs between the two rows of bristles where they seem to be whiter on account of the absence of hairs. Wings almost hyaline, widest a little beyond the large crossvein, at which point the costa begins to bend backward; fourth vein ending rather far before the apex, almost parallel with the third; a distinct notch in the hind margin at the tip of the fifth vein; anal angle small; costa not thickened at the junction of the first vein.

Length of male, 5.4 mm.

Described from 1 male, on rocks by stream, Rio Ruidoso, White Mountains, New Mexico, about 6,500 feet altitude (1.98 kilometers), July 30, collected by C. H. T. Townsend.

Type.—Male, Cat. No. 25237, U.S.N.M.

Runs to *terminalis* in couplet 58 on page 26, but differs in the very large wide lamellae, in having the front tarsi darkened from the first joint instead of only the last joint, and in some other minor characters.

DOLICHOPUS EXSUL, new species.

Male.—Front green, face silvery white, rather narrow below. Palpi yellow. Orbital cilia white except a few of the upper ones. Antennae short, broadly reddish below including the third joint.

The first joint narrowly blackish on the upper edge, the third mostly brown.

Mesonotum shining green with a coppery stripe on each side along the suture. Scutellum shining green. Pleurae blackish green, covered with a thin gray dust. Cilia of the calypters black. Halteres yellow. Abdomen shining green, but less bright than the thorax. Posteriorly it is compressed. Hypopygium large, blackish green. Lamellae nearly circular, white with a very narrow dark border. The front edge deeply incised from half a dozen long processes with bristles at the tip.

Legs yellow. The middle and hind coxae blackish except at tip. The hind tibiae blackened from about the middle to end. Tarsi entirely black. Front and middle tarsi gradually infuscated toward the apex. Front coxae with black hairs on the anterior surface.

Wings hyaline, rather narrow in shape, the anal angle not very prominent. The fourth longitudinal vein sharply bent beyond the cross vein with a stump of a vein at one or both of the bends. Costa with an elongated swelling not very large at the junction of the first vein.

Female.—Face about half wider than in the male. Hind tibiae infuscated on the apical fourth, otherwise about as in the male.

Length 4 mm.

Described from 6 males and 5 females collected at Tantalus and Waialua, Oahu, and at Olaa, Hawaii, 2,500 feet (0.76 kilometer), all in the Hawaiian Islands, by W. H. Ashmead.

Type.—Male, Cat. No. 25197, U.S.N.M., from Tantalus.

This is the only true *Dolichopus* known to me to occur in a tropical climate. The species is not known from North America; it would run to *abrasus* on page 20 in the tables of Bulletin 116, but is readily separable by its short, broad lamellae. It may have been introduced from Japan, but the species of that region are too imperfectly known as yet to settle that point.

Genus HYDROPHORUS Fallén.

Hydrophorus FALLÉN, Diptera Sueciae, Dolichopodes, 1823, p. 2.—LOEW, Smiths. Misc. Colls., No. 171, 1864, p. 211.—ALDRICH, Psyche, vol. 18, pp. 45-73, 1 pl., 1911.

Six species of this genus were collected in Alaska in my expedition of June and July, 1921; one was undescribed, none European, and all but two occur in the United States.

HYDROPHORUS ALTIVAGUS Aldrich.

Hydrophorus altivagus ALDRICH, Psyche, vol. 18, p. 67, 1911.

Ten specimens, Anchorage and Fairbanks, Alaska. Described from Colorado, and I afterwards collected it at Moscow, Idaho.

HYDROPHORUS BREVISETA Thomson.

Medeterus breviseta THOMSON, Fregat. Eugenies Resa, 1868, p. 150.
Hydrophorus breviseta ALDRICH, Psyche, vol. 18, p. 58, figs., 1911.

Four specimens, Seward and Skagway, Alaska. Described from California, presumably San Francisco; since reported from the Puget Sound region.

HYDROPHORUS INNOTATUS Loew.

Hydrophorus innotatus LOEW, Smiths. Misc. Colls., No. 171, p. 212, 1864.—ALDRICH, Psyche, vol. 18, p. 66, 1911.—MALLOCH, Rept. Canad. Arctic Exped., vol. 3, p. 50c, 1920.

Eight specimens, Skagway, Alaska, June 4, and Seward, Alaska, July 24. Originally described from Sitka, and since reported from Arctic Canada, Oregon, and Washington.

HYDROPHORUS GRATIOSUS Aldrich.

Hydrophorus gratiosus ALDRICH, Psyche, vol. 18. p. 49; Entom. News, vol. 24, pp. 215, 217, 219.

Two specimens, Anchorage, Alaska, July 21, and Seward, Alaska, July 24. Described from Idaho, Washington, and California, and since reported from Utah and Nevada.

HYDROPHORUS SIGNIFERUS Coquillett.

Hydrophorus signiferus COQUILLETT, Fur Seals and Fur Seal Islands, vol. 4, p. 344, 1899.—MALLOCH, Rept. Canad. Arctic Exped., vol. 3, p. 50c.

One female, Healy, Alaska, June 26. Described from Bering Island, and reported with additional description by Malloch from Teller, Alaska. The National Museum has eight specimens collected by J. M. Jessup in 1912 on the Alaska-Yukon boundary at latitude 69° 20′.

HYDROPHORUS AQUATILIS, new species.

Female.—Front with gray pollen, along the orbits thinner so as to show a little of the green color beneath; face entirely gray pollinose; cheek below the eye rounded and narrow; beard yellowish; antennae black, of ordinary size; occiput with a single pair of bristles. Mesonotum yellowish gray pollinose, with brownish reflections which are brighter above the wings; pleurae of the same color; propleura with yellow hairs and one yellow bristle; calypters with yellowish cilia. Halteres decidedly black, the stem yellow except at base. Abdomen greenish, coppery, with a thin gray pollen. Legs black, the femora with greenish reflections; front coxae covered with yellowish pollen, with rather long yellow hair in front and without any black bristles even at the tip. Front femora moderately thickened at base, with a row of seven or eight spines hardly reaching the middle, and some scattered much shorter spines extending along the inner side of this row and somewhat beyond. The front tibia almost straight, on the extensor side with a row of short even bristles; on the flexor side a denser row of more erect and shorter little spines, terminating in one which is a little longer; middle and hind femora very slender. Wings long and narrow, uniformly tinged with brown, without any distinct spots.

Length, 3.8 mm.

Two females, Fairbanks and Nenana, Alaska.

Type.—Female, Cat. No. 25409, U.S.N.M., from Fairbanks.

○

Indian Agricultural Research Institute
LIBRARY, NEW DELHI-110012

This book can be issued on or before ....

Return Date	Return Date